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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Application of Southern California Edison Company (U338E) for Approval of its 2012-2014 California Alternate Rates for Energy (CARE) and Energy Savings Assistance Programs and Budgets.	Application 11-05-017 (Filed May 16, 2011)
And Related Matters.	Application 11-05-018 Application 11-05-019 Application 11-05-020

ADMINISTRATIVE LAW JUDGE'S RULING ADMITTING THE MULTIFAMILY SEGMENT STUDY

The attached final Multifamily Segment Study is ruled into the record of the above-captioned consolidated proceeding, for the Commission's consideration.

IT IS SO RULED.

Dated August 1, 2014, at San Francisco, California.

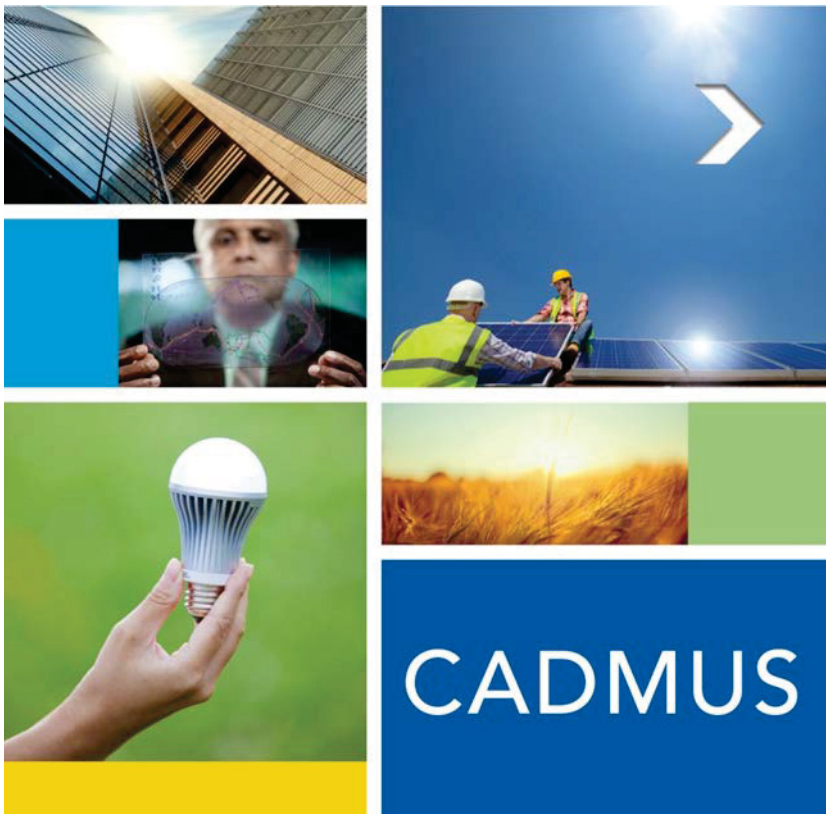
/s/ KIMBERLY KIM
Kimberly Kim
Administrative Law Judge

100558625

ATTACHMENT

ESA MULTIFAMILY SEGMENT STUDY

VOLUME 1



research into action inc

ESA Program
Multifamily Segment Study
Volume 1: Report

December 4, 2013

The Cadmus Group, Inc.

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Executive Summary

Initially offered in the early 1980s, the Energy Savings Assistance (ESA) Program is a mature, ratepayer-funded initiative that provides subsidized energy-efficiency services to low-income households that cannot otherwise afford energy-efficiency upgrades. The objectives of the ESA Program are these:

- To provide low-income customers with ways of reducing their energy bills, and
- to improve the quality of life of these customers through home weatherization and energy-efficiency measures.[1]

The California Investor-Owned Utilities (IOUs) administer the ESA Program, making it available to homeowners and renters living in single-family dwellings, multifamily dwellings, and mobile homes.

In Decision 12-08-044, the California Public Utility Commission (Commission) mandated that the IOUs do the following:

- Implement immediately eight specified strategies to improve ESA's penetration into the multifamily segment of the low-income population;[2]
- Conduct a Multifamily Segment Study of the 2012-2014 program cycle; and
- Administer the ESA Program "to yield maximum energy savings at reasonable costs."[3]

The IOUs then engaged Cadmus to conduct the Multifamily Segment Study, and the results of that effort are presented in this report. In this study, Cadmus addresses the two goals for the ESA Program and the three directives of Decision 12-08-044. Thus, the study was designed with this overarching objective in mind: Develop a detailed picture of the low-income multifamily market (including segment profiles). Through our research, the Cadmus team gathered important data that can be used to:

- ***Develop comprehensive multifamily segment strategies for the ESA Program.*** These strategies will aid California in preparing and promoting effective long-term plans to meet the needs of low-income IOU customers living in multifamily housing.
- ***Inform recommendations that enhance program design and delivery***, so as to help California meet its 2020 energy targets.

An important challenge associated with this study is that while the ESA Program focuses on providing services to households (families and individuals), Decision 12-08-044 has an implied focus on upgrading

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[1] California Public Utilities Commission. *California Energy Efficiency Strategic Plan.* January 2011 Update, pp. 23-24.

[2] D.12-08-044, p. 157. The eight strategies are listed in Appendix A of this report. Note that examination of these eight strategies or determining whether the steps were successful in reaching the multifamily segment were outside the scope of the Multifamily Segment Study.

[3] D.12-08-044, p. 3.

multifamily buildings, which may or may not provide direct benefits to income-qualified multifamily tenants.

The background for—and an overview of—this study are presented in the following sections.

Introduction

On August 23, 2012, the California Public Utility Commission (Commission) approved Decision 12-08-044 for the 2012-2014 program cycle, allocating approximately $5 billion to continue two energy-related low-income programs: the ESA Program and the California Alternate Rates for Energy (CARE) Program for the IOUs. As detailed in the California Strategic Plan for Energy Efficiency—and later codified in PU Code Section 382(e)—the Commission's vision for low-income communities is that "by not later than December 31, 2020, ensure that all eligible low-income electricity and gas customers are given the opportunity to participate in low-income energy efficiency programs, including customers occupying apartments or similar multiunit residential structures." (Note that for this research, multifamily buildings are defined as "dwellings with five or more housing units."[4] Also, low-Income customers are defined as "households with gross income equal to or less than 200% of the Federal Poverty Guidelines."[5])

The Commission proposed a dual approach for ESA and mandated that the IOUs immediately implement eight strategies to improve ESA's penetration into the multifamily segment of the low-income population.[6] The second and complementary approach (D.12-08-044, Section 3.10.6.4) mandated that the IOUs conduct a Multifamily Segment Study. Additionally, Decision 12-08-044 mandated that the IOUs administer the ESA Program "to yield maximum energy savings at reasonable costs."[7]

Research Objective

For this Multifamily Segment Study, Cadmus was to develop a detailed picture of the low-income multifamily market (including segment profiles). As previously noted, the results of this research will serve as the basis for: (1) comprehensive multifamily segment strategies to promote the ESA Program; and recommendations to enhance the program, so as to meet California's 2020 targets.

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4 Statewide Low-income Energy Efficiency Program Policy and Procedures Manual. California Public Utilities Commission. August 2010.

5 California Public Utilities Code Section 739.1(b)(1) The commission shall establish a program of assistance to low-income electric and gas customers with annual household incomes that are no greater than 200 percent of the federal poverty guideline levels, the cost of which shall not be borne solely by any single class of customer. The program shall be referred to as the California Alternate Rates for Energy or CARE program. The commission shall ensure that the level of discount for low-income electric and gas customers correctly reflects the level of need.

6 Note that examination of these eight strategies or determining whether the steps were successful in reaching the multifamily segment were outside the scope of the Multifamily Segment Study.

7 D.12-08-044, p. 3.

Research Methodology

The Cadmus team used a multi-method approach to conduct the low-income Multifamily Segment Study. The key methods for gathering and analyzing data were these: primary and secondary research, quantitative (data analyses and geocoding), and qualitative techniques (literature searches, surveys, interviews, and input from public workshops). We drew upon this research to: (1) identify opportunities to reach deeper into the low-income multifamily market; (2) address and improve the energy efficiency and quality of life in as many low-income households as possible; and (3) maximize cost-effective energy savings in this sector.

After conducting key informant interviews for background and context for the Multifamily Segment Study, Cadmus' evaluation team conducted these research tasks.

- ***Develop low-income multifamily housing characteristics*** using data from the American Community Survey, American Housing Survey, and GIS technology. (Section 3 of this report)
  - Estimate the number of low-income multifamily households in California and apportion those households by IOU service territory, by county, and by census tract.
  - Profile the characteristics of the low-income multifamily segment based on additional metrics.
  - Determine average costs of measure installations using IOU data on past ESA Program multifamily projects.
- ***Survey building owners and managers of low-income multifamily buildings*** (including market rate properties and rent-assisted properties). Cadmus collected data about ownership, buildings and equipment, and decision-making related to energy-efficiency upgrades in apartment units and the common areas in multifamily buildings. (Section 4)
- ***Interview low-income stakeholder and advocacy organizations working with affordable and market-rate multifamily housing*** to collect information about considerations associated with financing multifamily building improvements and energy-efficiency upgrades. (Section 4)
- ***Identify comparison programs nationwide that target multifamily buildings or residents.*** After cataloging programs representing a range of design and delivery approaches, we conducted additional research on five selected programs. The purpose of the national program comparisons was to identify approaches to reaching the low income multifamily sector. In formulating recommendations, the research team considered these approaches in the context of the existing California program landscape and the characteristics of the low income multifamily market in California. The selected programs are implemented by: CNT Energy, Energy Outreach Colorado (EOC), Massachusetts Gas and Electric IOUs, NYSERDA, Public Service Electric and Gas Company (PSE&G). (Section 5)
- ***Examine California's low-income multifamily energy-efficiency program landscape***, which includes: the ESA Program; the federally funded weatherization program administered by the

California Department of Community Services and Development (CSD Program);[8] the Multifamily Energy Efficiency Rebate (MFEER) program; and whole-building efficiency programs, such as including the IOUs' Energy Upgrade California Multifamily Path (EUC MF Path) and the multifamily programs offered by the Bay Area Regional Energy Network (Bay REN) and the Southern California Regional Energy Network (SoCal REN). (Section 6)

- ***Research and catalog financing and funding options*** available to owners of low-income multifamily properties for energy-efficiency upgrades. (Section 7)
- ***Propose strategies to enhance the program's ability to serve income eligible households, encourage participation, and maximize cost-effective energy savings.*** (Section 8)

Key Research Findings

The ESA Program's current delivery strategy is designed around its mission to deliver program services that benefit individual households and, as such, this strategy is well suited to - maximizing the number of low-income multifamily customers benefitting from the program. However, as the program matures, it will become increasingly difficult to reach 100% of eligible low-income customers, largely because eligible, willing, and untreated households will be harder to find.

Due largely to the physical characteristics of multifamily housing, coupled with restrictions in existing ESA Program policies and procedures, the economic benefits provided to low-income tenants through the program are relatively limited. Further, some of the strategies recommended in Decision 12-08-044,[9] indicate an implied preference for program services that appeal to building owners, as a way to reach the individual tenants in each unit and maximize energy savings.

Low-Income Multifamily Housing Characteristics

Within California, there are approximately 3.719 million low-income households (those earning no more than 200% of the Federal Poverty Guidelines), representing about 30% of all households. Of these, approximately 1.175 million live in multifamily housing, which includes all buildings with five or more units. Statewide, low-income multifamily households represent approximately 9% of total residential households, 32% of low-income households, and 42% of multifamily households. (This total includes some double-counting, as some households are served by two of the utilities.) The percentage of low-income multifamily households varies widely across IOUs, ranging from 39% to 27%.

Using data from the 2011 American Community Survey and GIS technology, we estimated the number of low-income multifamily households in California and apportioned those households by IOU service

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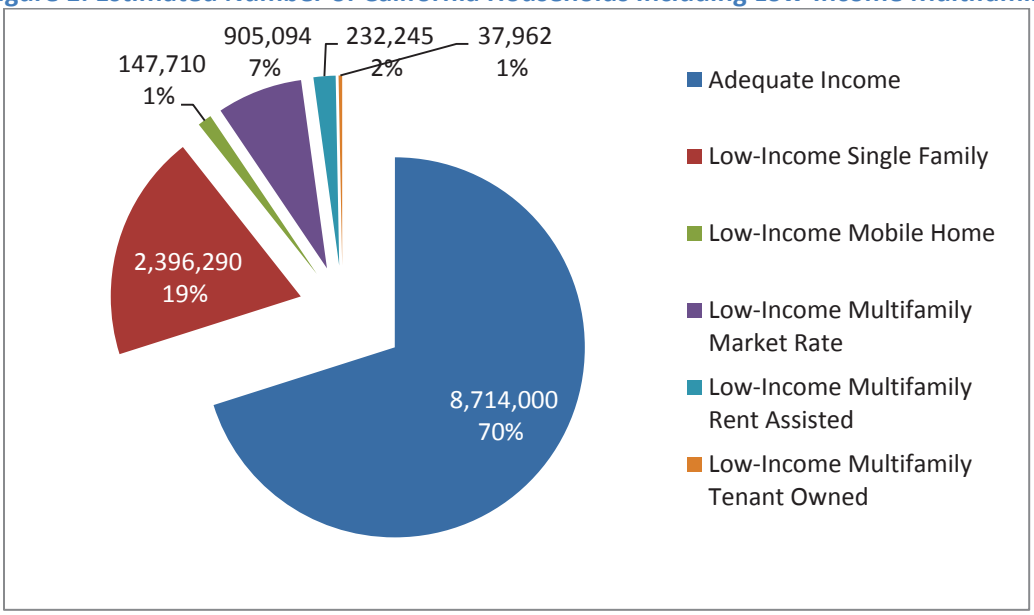
8 CSD administers weatherization programs with funding primarily from the U.S. DOE's Weatherization Assistance Program (WAP) and the U.S. Department of Health and Human Services' Low-income Home Energy Assistance Program (LIHEAP), although the program also received American Recovery and Reinvestment Act stimulus funds.

9 See Section 6, under Decision-12-08-044. See also Appendix A of this report. Specifically, strategies 3, 4, and 5 recommend greater marketing, coordination, and delivery consistent with a building, rather than tenant, approach..

territory, by county, and by census tract. Figure 1 shows the estimated number of households in California by income category and housing type.

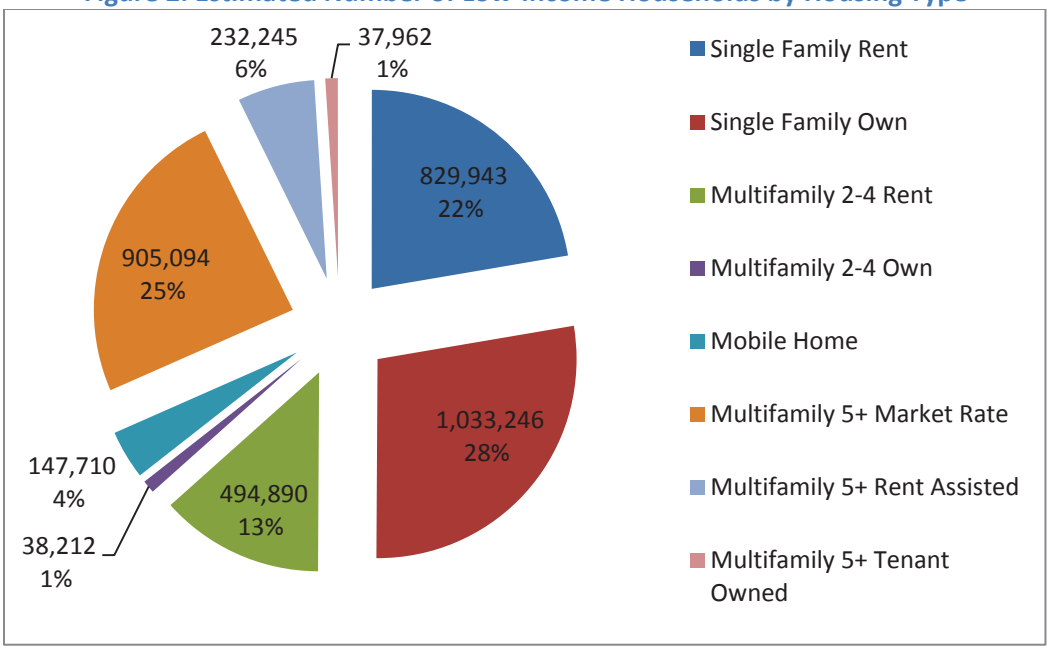
Figure 1. Estimated Number of California Households Including Low-Income Multifamily



Source: 2011 American Community Survey and 2011 American Housing Survey

Figure 2 apportions low-income households in California across categories of building type and ownership status. About 32% of low-income households live in housing categorized as "multifamily" (buildings having five or more units) by the ESA program.

Figure 2. Estimated Number of Low-Income Households by Housing Type



Source: 2011 American Community Survey and 2011 American Housing Survey

Table 1 shows the rate of program participation among low-income multifamily households during the program years 2007 to 2012 and the average annual participation. We note that the actual goals of the program take into consideration characteristics that we have not been able to assess for this research. Among these are the number of households that do not meet a minimal criterion for receiving measures and the number of households that are either resistant to participation or are not able to participate for various reasons. Thus, from the program standpoint, the denominator for full participation is a subset of total households. However, what we present is the number of households meeting only the criteria of program income eligibility (up to 200% of Federal Poverty Level guidelines) and building type (multifamily 5+ units).

Table 1. Rate of ESA Program Participation among Low-Income Multifamily Households PY 2010 to PY 2012

Utility	Estimated Low-Income Multifamily Households	Participating LIEE Households PY 2007 to PY 2009	Participating ESA Households PY 2010 to PY 2012	Average Annual Participation PY 2007 to PY 2012
PG&E	377,015	22,678	58,877	13,593
SCE	335,484	5,061	65,775	11,806
SCG	591,929	15,779	64,510	13,382
SDG&E	116,904	15,711	32,670	8,064

Because census data are organized around individuals and households, our data do not provide clear evidence of the number of buildings within which low-income multifamily households reside. Our results include information about the number of units in the buildings within which respondents reside; however, we do not have specific data regarding the percentage of units in each building that are inhabited by low-income households. This would be critical to an accurate estimate of the number of buildings housing low-income multifamily households. By making an assumption about this "mixing ratio" of low and adequate income households, we have provided an estimate of buildings.

Table 2 shows the estimated number of low-income multifamily buildings by utility. We have also disaggregated the total to show our estimates of rent-assisted households and market rate households.

Table 2. Estimated Number of Low-income Multifamily Buildings by Utility and Sector

Utility	Buildings Housing LIMF Households	Rent-Assisted	Market Rate
PG&E	33,889	7,996	25,893
SCE	30,128	6,866	23,262
SDG&E	10,546	2,794	7,752
SCG	52,812	9,196	43,616

The low-income multifamily sector is quite literally a moving target. The ESA Program treats *housing units* in order to provide benefits to *households,* but households are highly mobile, whereas the

treatments remain behind. By 2020, based on AHS data for the California low-income multifamily sector, we would expect 82% of low-income multifamily households to have moved to a different housing unit at least one time.

The most notable characteristic of the low-income multifamily segment is its variety, both in the social circumstances of the households and, more germane to the current research, in the physical structures and the energy-consuming equipment with which they live. For instance, the variety in the sizes and vintages of multifamily buildings within which low-income households reside influences the approach that is optimal for addressing their need. Size and vintage are not equally distributed across the territories but rather vary by metropolitan area.

Over the next few years, it will be important to consider the vintage of existing equipment and housing in plans to maximize energy savings. The 68% of low-income multifamily households living in units built before 1980 represent approximately 766,000 households within the IOUs' service territories.[10] This is the segment most likely to benefit from building shell improvements (such as ceiling and wall insulation, roofing, or windows), although buildings of later vintage may also benefit and some of these pre-1980 units may have already received shell upgrades. We estimate about 79,942 low-income multifamily households living in the IOUs' high-need climate zones 11 through 16 within buildings in likely need of shell improvement.

About 347,000 households among the IOUs' low-income multifamily customers have heating equipment that is 20 years old or older. Data suggests that about 21,000 buildings (serving an estimated 207,000 households) have furnace equipment at the end of its effective useful life. We estimate there are 39,500 central AC systems that are 20 years old or older. We estimate that roughly 94,000 low-income multifamily households have refrigerators that are 15 years old or older.

The California Landscape and Comparison Programs

The programs selected for in-depth comparison operate in areas with climates very different from much of California. However, low-income tenants and multifamily building owners across the country likely face similar considerations in their decisions regarding energy efficiency. As a result, the comparison programs' established and well-documented approaches to reaching the low-income multifamily sector may provide insight into program delivery approaches that could be effective in California.

The in-depth comparison of other multifamily programs offered in other states all included activities in five key areas expected to help achieve efficiency retrofits in low-income multifamily buildings. The comparison programs were notable for the presence and role of nonprofit and public benefit organizations in both administering and delivering services to multifamily buildings. As a whole, the

[10] Our estimate of the number of low-income multifamily households within the combined utility territories is 1.127 million. Sixty-eight percent of 1.127 million is 766,000. The value reported above, 1.175 million households is a statewide number.

comparison programs prioritized a comprehensive treatment of the buildings they targeted, with some covering substantial (if not all) of the retrofit costs.

Our research shows that existing ESA Program policies that prohibit addressing an entire building may be missing opportunities to treat more tenant units and increase energy savings within a given building. The ESA Program may be able to increase energy savings results and likely serve more low-income households by relaxing the eligibility requirements associated with addressing low-income multifamily buildings as a whole.

Neither the current ESA Program nor the other multifamily sector programs offered by the IOUs are designed specifically to maximize energy savings in low-income multifamily buildings. Put more simply, there is a gap in the current multifamily program landscape in California (i.e., ESA, MFEER, EUC MF, and MIDI) whereby multifamily buildings that primarily or exclusively serve low-income residents do not have access to incentives for common area and central system upgrades that are specifically set at levels to address financial barriers common to this sector.

Better coordination and technical support is needed for multifamily building owners and tenants who are eligible for multiple programs to ensure their participation derives maximum energy savings and other benefits. While the building owner can be difficult to engage, once engaged, communications with the building owner presents an opportunity for the IOUs to work with them to capture more significant energy savings by installing upgrades to larger, building-wide systems.

Recommendations

The California IOUs have already accomplished a great deal to help low-income residents reduce their utility costs and improve the comfort and safety of their households through the ESA Program. Each utility is committed to continuous improvement of the ESA Program: they are working to align their ESA Programs with the Strategic Plan and codified PU Code goals and making steady progress to streamline operations and improve outreach to target low-income multifamily residents. The individual IOUs should continue these efforts. Furthermore, the research team recognizes that the IOUs operate in fidelity to an existing programmatic framework that entails rules, policies, and procedures set by the Commission that may limit their ability to implement significant program design adjustments.

It is important to note that under existing program funding cycles and funding allocation, there are limited programmatic resources for energy efficiency. Increasing services in one segment may not be desirable if it affects service delivery to another important segment of the population. The final decisions about the implications and trade-offs within or between other programs are not in the purview of this research, instead, those are determinations to be made by policymakers. Thus, any recommendations must be considered within the regulatory context and program delivery constraints inherent in the existing California market.

To address the range of study objectives, Cadmus presents two sets of recommendations. The first set of recommendations is geared toward doing more within the existing ESA Program framework to reach the

increasingly hard-to-reach populations and attract more income qualified households to the program (that is, up to 200% of Federal Poverty Level guidelines). Because the program will always need a means to treat an individual household and apartment unit, we recommend keeping the existing program delivery structure. These recommendations build on the existing infrastructure. In general, the research team believes implementing the recommendations in this section would be feasible under existing ESA Program rules and do not require significant regulatory involvement.

1. ***Consider adopting customized recruitment and delivery strategies*** (by IOU) to target identified opportunities based on climate zone, measure and buildings characteristics, and geographic areas.
2. ***Treat all units (whether vacant or occupied) and the building shell in those buildings where 80% of the tenants are income-qualified.***
3. ***Consider options for expanding current process exceptions to subsidized buildings.***

The second set of recommendations, in keeping with the implied goals of Decision 12-08-044, is geared toward maximizing cost-effective energy savings through the ESA program. Achieving this objective entails a comprehensive approach to treating low-income multifamily buildings. Therefore, these recommendations provide suggestions for more significant programmatic changes that potentially entail adjustments at a higher level than can be accomplished by the individual IOUs.

4. ***Ensure consistency with the current policy objectives*** by reviewing the rationale behind the 80-20 threshold for treating all units and the building shell.
5. ***Consider offering cost-effective common-area measures and incentives that cover the incremental cost*** of central heating and cooling system replacements.
6. ***Consider researching building recapitalization cycles*** to inform marketing strategies that target building owners.
7. ***Consider options for integrating the ESA Program with MFEER and/or EUC MF*** to create a comprehensive project path for ESA building owners.

Organization of this Report

- Section 1 discusses the Multifamily Segment Study's research objectives, provides background about the Commission Decision that directs the study, and provides background about the ESA Program. The section summarizes the multi-methods research approach used to conduct this study and provides details about the methods. Data sources and data limitations are also discussed.
- Section 2 discusses findings and conclusions stemming from this research, addressing eight primary research questions that underlie the study. The key findings and conclusions presented in this section flow from the individual research tasks discussed in Sections 3 through 7.
- Section 3 presents California multifamily housing data relevant to low-income multifamily housing programs.
- Section 4 summarizes findings from (1) surveys with owners and managers of low-income multifamily buildings, including representatives from rent-assisted (also referred to as affordable housing) and market rate housing, and (2) interviews with low-income advocacy groups and stakeholders who represent, own, or manage market-rate and affordable housing.
- Section 5 compares low-income multifamily programs across the United States, describing features that may be useful for California IOUs to consider.
- Section 6 describes the current California landscape for low-income and multifamily programs. This section discusses the ESA program, MFEER, CSD, EUC.
- Section 7 discusses research on a limited number of financing and funding options that consider energy efficiency and may be available to owners of multifamily building with high numbers of ESA qualified tenants.
- Section 8 consolidates findings from this research in order to draw broad conclusions regarding the ESA Program's alignment with the study objectives. We further provide recommendations for the IOUs to consider that are intended to help the IOUs reach and serve the low-income population living in multifamily housing and maximize cost-effective energy savings.

Appendices A through K (in a separate Volume of this report) provide additional detail about the research methods, findings, and supporting materials.

- Appendix A lists the objectives of the study as outlined in Decision 12-08-044. It summarizes specific passages in the Decision and the page number, commonly referenced in this report. The appendix lists the eight Multifamily Segment Strategies the Commission directed the IOUs to implement.
- Appendix B lists the stakeholders providing public comments on Decision 12-08-044.
- Appendix C details the methodology used in Section 3 to estimate the distribution of low-income multifamily housing.
- Appendix D details the methodology used in Section 3 to determine the characteristics of low-income multifamily housing.
- Appendix E details the methodology used in Section 3 to estimate the penetration of ESA Program and MFEER penetration into the low-income multifamily sector.

- Appendix F expands on Section 4 and provides details about the methodology and sampling plan for the survey conducted with building owners and managers. It also discusses challenges the Cadmus team encountered conducting this survey.
- Appendix G details the research methodology and sample frame for the interviews with low income stakeholder and advocacy groups working with market rate and/or rent-assisted multifamily buildings. The interview findings are discussed in Section 4 of this report.
- Appendix H summarizes the eligible measures for California programs targeting the multifamily sector. The programs are discussed in Section 5 of this report.
- Appendix I provides additional detail for the 16 financial and funding options reviewed in Section 7 of this report.
- Appendix J summarizes measures installed in multifamily households through the ESA Program by each of the four IOUs, referenced in Section 3 of this report.
- Appendix K is the bibliography.

Section 1. Background, Research Objectives, Methodology, Data Sources and Study Limitations

Study Background

On August 23, 2012, the CPUC approved Decision 12-08-044 for the 2012-2014 program cycle, allocating approximately $5 billion to continue two energy-related low-income programs: the Energy Savings Assistance (ESA) Program and the California Alternate Rates for Energy (CARE) Programs for the California Investor-Owned Utilities (IOUs).

As detailed in the California Strategic Plan for Energy Efficiency and later codified in PU Code Section 382(e), the Commission's vision for low-income communities is that "by not later than December 31, 2020, ensure that all eligible low-income electricity and gas customers are given the opportunity to participate in low-income energy efficiency programs, including customers occupying apartments or similar multiunit residential structures." In addition to producing energy savings, the dual objectives of the ESA Program are to provide low-income customers with ways to reduce their energy bills and improve their quality of life.[11] In accordance with those complementary objectives, Decision 12-08-044 directs the IOUs to administer the ESA Program "to yield maximum energy savings at reasonable costs"[12] and to "provide an improved quality of life for the low-income populations" through home weatherization and efficiency measures.[13]

Testimony by the IOUs, several ratepayer and low-income advocates, and the Commission's response discussed visions for "smarter and streamlined program implementation, by increasing consistency and coherence in delivery of demand side programs, and by promoting and encouraging creativity, innovation, and efficiency through tailored, adaptable and flexible program delivery" (D.12-08-044, p. 7). To that end, the Commission proposed a dual approach for the ESA Program and mandated that the IOUs immediately implement, as the first prong in the approach, eight multifamily segment strategies to improve the ESA Program's penetration into the multifamily segment of the low-income population. The second and complementary approach (D.12-08-044, Section 3.10.6.4.) mandated that the IOUs conduct a Multifamily Segment Study.

As the ESA Program matures, the intent of the Commission and the IOUs is to encourage more efficient program delivery, integrating efforts with other demand-side program offerings, and developing strategies for the next eight years, toward meeting the 2020 program goals. During the 2009-2011 program cycle, the ESA Program treated more than one million homes. The IOUs anticipate treating nearly another one million homes in the 2012-2014 program cycle, with a budget that exceeds $1

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[11] California Public Utilities Commission. *California Energy Efficiency Strategic Plan.* January 2011 Update, pages 23-24.

[12] D.12-08-044, pg. 3.

[13] *Ibid*, pg. 19.

billion. Among the changes to the 2012-2014 program cycle, the Commission expects the IOUs to continue efforts to integrate the ESA Program with other programs, to promote efficiencies by leveraging opportunities to coordinate delivery with other programs, and to take parallel approaches to increase participation of the multifamily segment of the low-income population. As the Commission noted in its Decision, "the program must be directed, administered, and delivered in a manner so as to yield significant energy savings."[14]

ESA Program Background

The respective IOUs administer the ESA Program in each service territory and it is available to homeowners and renters living in single-family dwellings, multifamily dwellings, and mobile homes. The ESA Program uses a direct-install approach to provide home weatherization (installing cost-effective measures at reasonable costs), energy-efficient appliances, and energy education services at no cost to income-qualified IOU customers. In its current design, the ESA Program serves income qualified residents in individual multifamily units; the program does not address multifamily building common areas or central systems. The building shell is addressed if at least 80% of the tenants in building are income-qualified for the ESA Program.

Multifamily Segment Study Research Objectives

The Decision D.12-08-044 directed the IOUs to conduct the Multifamily Segment Study to build a comprehensive understanding of this segment and develop long-term strategies to reach 100% of eligible and willing households by 2020 and meet program goals. This study's goals were driven by three key overarching questions.

The Cadmus team's assessment was guided by the IOU's and the Commission's goals for this study. Key research objectives provided the underlying context for the research and recommendations:

- How can the current ESA Program be modified to better meet the needs of low-income multifamily residents?
- How can integrated outreach, education, and marketing be most effective in reaching low-income multifamily housing owners and operators?
- Could the current service delivery approach be modified to address multifamily, energy-efficiency programming concerns?

With this backdrop and research objectives in mind, the Decision and the Study Team outlined eight key research questions that the research tasks were designed to address. The eight questions are:

1. What are the characteristics of the low-income multifamily segment?
2. Where are the low-income multifamily buildings located?
3. In what ways is this segment being served through the existing ESA Program?
4. Who is the multifamily customer: the tenant or the building owner?

[14] D. 12-08-044, page 3.

5. What is available (services and benefits) to the multifamily customer now, via IOU or other programs?
6. What do multifamily customers need from the IOUs?
7. What are the barriers to serving multifamily customers?
8. How are other multifamily programs offered? What are their organizing principles?

Research Methodology and Data Sources

The Cadmus team developed a research plan responding to the IOUs' request for a study, describing activities that were in very close alignment to those discussed in Decision 12-08-044. The Cadmus team proposed a research plan within the time and funding constraints described by the Commission, discussed the proposed plan with the Study Team, and secured the team's approval before research commenced. Cadmus and the Study Team posted the draft research plan on energydataweb.com, received public comments, and discussed the plan in the first public workshop in February 2013. Comments and directions from the Study Team and the public were reflected in the approved research plan.

The Cadmus team used a multi-methods approach to conduct the low-income Multifamily Segment Study and to characterize this complex market segment. Using more than one method provides a more complete set of findings, reduces uncertainty, and increases confidence that the multifamily segment is robustly characterized. The team used primary and secondary research as well as quantitative (data analyses and geocoding) and qualitative methods (literature searches, surveys, and interviews) to gather and analyze data.

Our approach to developing and understanding the characteristics of low-income multifamily households was directed toward objective indicators of what this sector might need to increase energy efficiency. We took as fundamental the overriding objective of the ESA Program: to provide energy efficiency measures to households that might not otherwise be able to install them. We focused on a depiction of the overall landscape: its dimensions and its particular characteristics. On the whole, we are confident in the quality of the data collection efforts and in the results of this analysis. We hope and expect the information this study provides will be combined with other research to inform decision-making for this tremendously complex sector.

Table 3 summarizes the primary research activities and methods utilized in this study.

Table 3. Multifamily Segment Study Research Methods

Research Activity Identified in D.12-08-044	Multifamily Segment Study Research Method
Gather data on the state's multifamily housing stock and ownership profiles, including a statewide demographic and programmatic assessment of California's low-income multifamily housing stock (by each IOU territory and by county).	**Key informant interviews** conducted with managers of the four IOUs provided background and context. **IOU customer data** identified customers for survey sample. **IOU program data** identified measures installed in the ESA Program. **Secondary research** included U.S. Census Bureau 2011 American Community Survey data, and American Housing Survey, identified low-income multifamily buildings within census tracts, building and apartment unit characteristics, numbers of units and estimated numbers of buildings. Regression models examined program penetration rates and differences based on demographic characteristics. Findings are presented by IOU service territory, by county, and by census tract. **Surveys** were conducted with a stratified random sample of 124 multifamily owners or operators in each IOU service territory identified ownership structures, building and unit characteristics, decision making and factors affecting energy efficiency upgrades. The sample was stratified by market sector (market rate and rent-assisted) and by property size (determined by numbers of units operated in CA). **GIS mapping** (geocoding) using IOU customer data, and socioeconomic census data identified areas where multifamily buildings have been served. Also used to identify census tracts with low-income households to develop the survey sample frame.

Catalogue multifamily energy-efficiency programs (particularly those for low-income customers), including Commission programs and those administered by other government agencies, utilities, and organizations within the state of California as well as the most successful and/or effective recent and ongoing multifamily energy-efficiency programs benefitting low-income customers administered in other jurisdictions across the country.	**Key informant interviews** with ESA Program managers provided background on program delivery channels, multifamily participants, and details about the databases; interviews with IOU multifamily, direct install, and EUC programs informed ESA program enhancement research. **Research** identified comparative multifamily programs in other states. Secondary and primary research provided data to help characterize the multifamily market. Examined 44 programs nationwide. Five key programs were examined in depth to collect data that can be used to enhance the ESA Program design. The research cataloged key program elements and identified delivery channels, examples where programs use a single point of contact, and various financing vehicles. **Research** identified and cataloged key low-income programs benefiting low-income customers in California. Assessed program elements, including delivery methods, single point of contact.
Evaluate and further examine proposals from parties to the ESA Program proceeding (A.11-05-017 et al.) in the context of previous ESA Program decisions, the current Commission directions (including the Spring 2011 Energy Division staff guidelines for a Multifamily Pilot), and the EE Strategic Plan.	**Reviewed materials** including testimony and proposals provided by stakeholders in response to ESA program proceedings, Commission directives, Decision, and Strategic Plan. Examination provided context and background to guide this research project.
Review other existing multifamily programs, projects and pilots benefitting low-income residents performed under other state programs **Review other recently completed** multifamily projects and pilots benefitting low-income residents performed under other state programs.	**Reviewed** other multifamily programs in California and developed a summary of the California landscape within which the ESA Program operates. Reviewed and compared ESA Program with MFEER, CSD, and EUC MF. Assessed program elements, including delivery methods, single point of contact. **Reviewed** California Energy Efficiency Strategic Plan, Decision 12-08-044, and the Multifamily Home Energy Retrofit Coordinating Committee (MF HERCC) report on multifamily program design **Interviewed 14 stakeholders** who are owners of market rate and/or rent-assisted properties.

Review and investigate options for new delivery methods for the ESA Program. Review coordination concerns related to any new delivery methods for the ESA Program with non-IOU financing and energy efficiency options.	**Interviewed key** ESA Program delivery contractor and other stakeholders who are owners of market rate and/or rent-assisted properties. **Utilized key findings** from other studies such as the Multifamily Energy Efficiency Rebate (MFEER) evaluation. **Research** of key low-income programs in the California landscape and relevant multifamily programs examined program delivery methods and financing options.
Identify available low-income and energy-efficiency financing options, and develop a funding and implementation schema utilizing the variety of energy-efficiency programs available for each multifamily housing owners/operators profile.	**Researched and cataloged** financing and funding options available to low-income multifamily building owners. Cataloged 16 options in this quickly changing market.
Review and investigate cost and budget implications of one or more approaches to low-income multifamily program implementation, including consideration of possible new cost-sharing arrangements and/or financing mechanisms that might be applied.	**Determined** average costs of measure installations using data from four IOUs summarizing ESA Program data for multifamily projects. Determined costs per unit replacement or incremental cost per unit. Proposed range of strategies for further consideration to enhance program's ability to serve low-income households, encourage participation, and maximize energy savings.
Hold public meetings to obtain, document, review, and consider all stakeholders' input.	**Three public workshops** were held. The first discussed the research plan with stakeholders who provided comment and input for the study, the second workshop provided interim research findings, and the third workshop summarized the study's conclusions and recommendations. The research plan and draft report were uploaded to energydataweb.com for public comment. The research team responded to comments, and comments were considered and addressed in final research plan and final report.
Propose (and possibly conduct) field studies, as needed.	**No field studies** were proposed or conducted.

The primary research tasks, their research methodologies and data sources are discussed in the following sections. Findings from each research task are described in separate sections of this report.

Background for the Multifamily Segment Study

Key Informant Interviews

Early in the research study, the Cadmus and Research Into Action team interviewed staff persons from each of the IOUs. The interviews provided background and context for the Multifamily Segment Study. Interviews were conducted at each IOU, with some member(s) of the Cadmus team at the IOU in person, and some on the phone. Staff persons typically included the IOU Study Team member, the ESA Program managers and others familiar with the program, the MFEER program managers, and person(s) working with EUC or developing the IOU's process to offer a single point of contact.

Testimony and Comments on Decision 12-08-044

The comments, proposed changes, and recommendations on Decision 12-08-044 from parties to the proceedings provided important context for the findings of this study. By understanding the issues and concerns raised by stakeholders, a more robust exploration of the multifamily segment was conducted. This information contributed to the development of key considerations for the study's findings and conclusions. Appendix A provides a summary of comments.

- Appendix A lists the objectives of the study as outlined in Decision 12-08-044. It summarizes specific passages in the Decision and the page number, commonly referenced in this report. The appendix lists the eight Multifamily Segment Strategies the Commission directed the IOUs to implement.
- Appendix B lists the stakeholders providing public comments on Decision 12-08-044.

Section 3. California Multifamily Housing Data Relevant for Low-Income Customer Programs

Methodology

Using data from the U.S. Census Bureau 2011 American Community Survey and GIS technology, we estimated the number of low-income multifamily households in California and apportioned those households by IOU service territory, by county, and by census tract. Geocoding was used to allocate census tracts to counties, climate zones, and utility territories to estimate the number of low-income multifamily households. Together with this information, the U.S. Census Bureau 2011 American Housing Survey provided information for developing a profile of the low-income multifamily segment on additional metrics such as building vintage, equipment, and amount of rent paid. We also conducted a regression analysis of program participation data and census data, to identify patterns in participation by census tract. The findings are discussed in Section 3, and details are provided in several appendices.

- Appendix C details the methodology used to estimate the distribution of low-income multifamily housing.
- Appendix D details the methodology used to determine the characteristics of low-income multifamily housing.
- Appendix E details the methodology used to estimate the penetration of ESA Program and MFEER penetration into the low-income multifamily sector.

- Appendix J summarizes measures installed in multifamily households through the ESA Program by each of the four IOUs.

Data Sources

The IOUs provided customer data for geocoding. Publicly available data were used for analysis, including the following. The Bibliography lists additional data sources.

- U.S. Census Bureau American Community Survey 2011
- American Housing Survey (AHS) Public Use File 2011; AHS is sponsored by the Department of Housing and Urban Development (HUD) and conducted by the U.S. Census Bureau
- The 2011 AHS data were used for eight MSAs identified in California: Anaheim, Los Angeles, Oakland, Riverside, Sacramento, San Diego, San Francisco, and San Jose
- 2009 California Residential Appliance Saturation Study, Palmgren et al. 2010, prepared for the California Energy Commission: Kema, Inc. CEC-200-2010-004
- Research data and discussions with John Peterson. "Athens Research Eligibility Estimates Documentation: Memo to the Joint Utilities Working Group." Athens Research, April 5, 2013
- U.S. Energy Information Administration. 2009. *Residential Energy Consumption Survey*

Section 4. Surveys with Owners and Managers of Low-Income Multifamily Buildings

Methodology

A survey with a stratified random sample of 124 building owners and managers of low-income multifamily buildings included owners and operators of market-rate buildings (73 respondents) and rent-assisted buildings (51 respondents). The *sector* strata differentiated between market-rate housing and assisted-housing. Respondents were further stratified by the number of units owned or operated in California (0-25 units, 26-249 units, and 250 units or more owned or managed). Survey weights were applied to answers according to the stratum the respondents represented. The final sample included respondents from all four IOU service territories, although this was not a stratum within the sample design. The sample design called for 300 surveys, including equal numbers in each stratum and post-weighting the responses. However, collecting survey data was challenging, evidenced by 124 completed surveys. The survey findings are discussed in Section 4 of this report.

Appendix F discusses the survey methodology and sampling plan in more detail. It also discusses challenges conducting the survey.

Data Sources

Cadmus relied on several resources to obtain the data for the affordable housing and the market rate sectors.

Affordable Housing Data Sources

Cadmus utilized public sources to develop the sample frame for property owners and managers. These sources included participants in the US Department of Housing and Urban Development's (HUD) Section 8 rental subsidy program. Property owners and managers in the Low-income Housing Tax Credit (LIHTC)

program administered by the California Tax Credit Allocation Committee (CTCAC) were included in the sample frame. These lists came from two sources; HUD and CTCAC. Also included was a list from the US Department of Agriculture for participants in the California Rural Development program. California Housing Partnership Corporation provided records with updated contact information of key decision makers. The initial population in this sector's population included 7,598 records. After filtering and removing duplicates the initial sample frame included 2,365 records. Following the survey pre-test, the list was further filtered and included 367 unique management contacts.

Market Rate Sources

IOUs provided customer data to compile a sample of property owners and managers for the market rate sector sample. To identify building managers or owners, Cadmus used contact information from master or common-area meter accounts in buildings with at least one CARE recipient. To identify this intersection, Cadmus required both individual tenant records with an identifier of CARE status, common area and master-meter account records. The customer data provided varied by IOU. The initial population included over 88,000 records. After filtering and removing duplicates the initial sample frame included 11,714 records. After the pre-test and additional filtering, the sample included 5,377 market rate records.

Convenience Sample

In addition to the sample compiled from the IOU customer data for the market rate housing sector, a convenience sample was compiled. This included additional records of multifamily property owners provided by SCE and records obtained through an internet search of housing associations. From the initial sample frame of 722 records, three surveys were completed.

Section 4. Interviews With Stakeholders and Advocacy Groups

Methodology

The research team conducted interviews with 14 low-income stakeholders and advocacy groups working with affordable- and/or market-rate multifamily housing, and with multifamily building owners and managers. These qualitative interviews collected information about the respondents' constituency and their respective financing considerations for multifamily building improvements. The interviews were not designed to represent a statistically significant sample of the California multifamily market. They represented a diversity of views and highlight the similarities and differences between the various stakeholder and advocacy groups. The respondents' views cannot be classified as belonging solely to affordable- or market-rate housing groups. The findings are discussed in Section 4.

Appendix G details the interview research methodology and sample frame. The appendix lists the agencies interviewed and their primary constituency.

Data Sources

Stakeholders were chosen through a process of reviewing:

- Formal documents designated as "comments" posted to the Commission Decision (D.) 12-08-044 on the Commission website[15]
- Roster of attendees from the Multifamily Segment Study public workshop on March 5, 2013
- Suggestions provided by attendees of the Multifamily Segment Study public workshops on March 5 and September 25, 2013
- Multifamily Executives Magazine's 2013 Top 50 Owners List
- Multifamily housing associations lists
- A.1111-05-017 Service List[16]

Section 5. Comparison Programs Across the Country

Methodology

The review sought to identify strategies that other programs have found to successfully reach the low-income multifamily market and included two primary tasks. The research team's first task was to catalog relevant multifamily programs operating throughout the United States. The team then selected a cohort for further investigation and more in-depth analysis.

Research Into Action identified 44 comparison programs nationwide that target multifamily buildings or residents. Fifteen of the 37 programs reviewed focused exclusively on the low-income multifamily market or had unique program offerings for low-income buildings or their tenants. To understand each comparison program, the research team conducted a more detailed literature review and in-depth interviews with specific program managers. These literature searches for other multifamily and low-income energy-efficiency programs offered in California and North America resulted in a catalog and profiles of programs which offered insight into program design and delivery approaches that may be transferable to California.

None of the programs identified in the catalog excluded multifamily buildings serving low-income tenants. However, many programs did not include specific strategies or services to overcome the unique challenges of serving low-income multifamily buildings. The research team conducted an in-depth review of five programs, expecting that they would yield the greatest insight into program approaches relevant to the ESA Program. The five programs chosen for in-depth comparison were selected because they served areas with large multifamily populations relative to the United States as a whole and because they represented a range of program approaches. The five were: CNT Energy; Energy Outreach Colorado (EOC); Massachusetts Gas and Electric IOUs; NYSERDA; and Public Service Electric and Gas Company (PSE&G).

The programs selected for in-depth comparison operate in areas with climates very different from much of California. It is important to consider these differences in climate in comparisons of the energy

[15] CPUC, Filed October 26, 2012, contact list for posting information regarding scheduled hearings.

[16] Ibid

savings accomplishments of the various programs and the cost effectiveness of the measures they offer. However, low-income tenants and multifamily building owners across the country likely face similar considerations in their decisions regarding energy efficiency. As a result, the comparison programs' established and well-documented approaches to reaching the low-income multifamily sector may provide insight into program delivery approaches that could be effective in California.

Findings are discussed in Section 5.

Appendix H provides a master list of measures eligible for these California programs.

Data Sources

The research team reviewed publically available information sources (including for example, American Council for an Energy-Efficient Economy (ACEEE) reports, program filings, monthly and annual program reports, evaluation reports, and information on program websites) to identify 44 programs outside of California that focus on low-income households, multifamily households, or both. Phone interviews were conducted for the five programs with in-depth reviews.

See Appendix K for the bibliography and additional data sources.

Section 6. The Current California Landscape for Low-Income Multifamily Programs

Methodology

The research team compiled a summary of the low-income multifamily energy-efficiency program landscape in California. The findings are discussed in Section 6.

1. Overarching goals for multifamily efficiency programs, drawing on the California Energy Efficiency Strategic Plan, Commission decisions, and the Multifamily Subcommittee of the Home Energy Retrofit Coordinating Committee (MF HERCC) report.
2. Efficiency programs targeting multifamily building owners and their tenants and interactions between the various programs.

Data Sources

This summary draws on in-depth interviews with IOU program staff, as well as a review of documents. The research team reviewed three documents that express overarching goals guiding the design of programs serving the low-income multifamily sector in California: the California Energy Efficiency Strategic Plan, Decision 12-08-044, and the Multifamily Home Energy Retrofit Coordinating Committee (MF HERCC) report on multifamily program design.

Section 7. Financing and Funding Options

Methodology

Cadmus researched financing and funding options available to multifamily property owners making energy-efficiency capital improvements, especially for properties with a high proportion of ESA Program-eligible tenants. This research was not intended to be limited to debt options, but to look at a

range of potential funding sources to support energy-efficient upgrades, including grants and tax incentives. To that end, "financing" in this section does not refer specifically to loans, but to any program the helps owners pay for an energy saving project.

The catalog presents a sample of representative programs and resources; it should not be regarded as an exhaustive list. Furthermore the catalog does not include programs offering nonfinancial support to energy-efficiency and renewable energy projects (such as permit expediting, although a reduced permit wait time may be financially advantageous in some situations). In addition, data may exist that was not available to our team, such as representative projects and number of projects completed. When interpreting data such as number of projects completed, it is good to note that the programs may not have much activity simply because they are new or because they lack marketing or administrative dollars, and not necessarily because of a failure of program design. The findings are discussed in Section 7 and additional resources are offered.

Appendix I provides additional detail for the 16 financial and funding options reviewed.

Data Sources

The Cadmus team conducted internet searches, phone interviews, and drew upon internal knowledge evaluating a number of utility on-bill financing and on-bill repayment programs.

Section 8. Conclusions and Recommendations

Methodology

Public workshops and regular weekly meetings with the Study Team provided input about areas of greatest interest and concern. From this input and research, we compiled data about options to fund energy-efficiency projects, barriers to upgrading buildings, and aligned findings reflecting barriers, drivers, and potentially replicable program models according to functional areas, such as eligibility rules, participant intake and enrollment, technical and administrative support, marketing and outreach, and delivery and implementation. Our task was to draw upon information gathered through primary and secondary research to identify opportunities to reach deeper into the low-income multifamily market, both addressing the needs of as many low-income households as possible and increasing cost-effective energy savings in this sector at a reasonable cost.

Study Limitations

The Multifamily Segment Study combined primary and secondary research to characterize this complex market segment.

The Study focused on low-income tenants (renters) in multifamily buildings with five or more units but not on single family home renters. There may be similarities between classes of renters, such as barriers to tenant participation and to capturing energy savings, which may apply to renters whether they rent apartments in multifamily buildings with more than five units, fewer than five units, or rent single family homes. Where these more general renter-related barriers exist we call them out; however, our primary focus is on the five-plus low-income multifamily market segment.

This research did not include in-depth process evaluations nor did we have the time or resources to conduct a full scale investigation of every program in California. The complexity of the landscape touching multifamily buildings housing low-income tenants is evident both in the challenges documenting the programs we reviewed and the myriad of program rules and exceptions that apply to a given program and building and unit. The IOUs are implementing these programs with fidelity to current program rules.

It is important to point out that, per the approved research plan, no tenant surveys or interviews were conducted for this project, and no on-site technical assessments or property inspections were conducted. Rather, to understand the tenant, the study focused on the household level data to characterize the tenants of low-income multifamily buildings, the energy-consuming equipment with which they live, the apartment units, and the physical structures. Extensive secondary research with census and AHS data, details these characteristics and other metrics. In addition, primary research with building owners and managers described energy related characteristics of the buildings and apartment units, and the factors important to their decisions to upgrade or replace equipment in the apartment units and common areas, and to improve energy efficiency of buildings and properties as a whole. Research identified financial options that could assist building owners to upgrade the energy efficiency of these buildings.

Interviews with interested stakeholders focused on a limited set of questions and their responses provided valuable input. We note that the limited input may not provide an accurate picture of their overall understanding of the program and program rules as implemented by the IOUs. The findings from these interviews may not necessarily reflect the specific needs, opinions, or objectives of the California IOUs and regulators or the rules under which energy efficiency program sponsors and administrators must operate.

The examination of comparison programs studied how other states deliver programs targeting the multifamily sector and provided insights that may assist the IOUs to reach the multifamily target market. The reviews of California's multifamily programs serving the low-income sector were not, and were not intended to be, an in-depth process evaluation of each program. Likewise, the assessments of comparison multifamily programs offered in other states were not in-depth process evaluations. Most program managers were not able to provide cost data describing the cost to treat each unit or cost to deliver the programs.

Section 2. Key Research Questions, Findings, and Themes

This section summarizes findings for key research objectives and discusses the themes emerging from research findings.

1. What are the characteristics of the low-income multifamily segment?

There are approximately 3.719 million low-income households within the state of California, representing about 30% of all households. Low-income multifamily households are those earning no more than 200% of the federal poverty guidelines. Of these, approximately 1.175 million live in multifamily housing which includes all buildings with five or more housing units. The low-income multifamily sector represents about 9% of total households and 32% of low-income households within the state.

In other respects, the most notable characteristic of this segment is its variety, both in the social circumstances of the households and, more germane to the current research, in the physical structures and the energy-consuming equipment with which they live. For instance, the variety among low-income multifamily households in the sizes and vintages of buildings where they reside shapes the approach that is optimal for addressing their need. Size and vintage is not equally distributed across the territories but rather varies by metropolitan area. San Francisco and San Jose have the highest percentage of buildings with 40 or more units (about 25%); San Diego and Anaheim have the lowest percentage (12% and 14%, respectively). San Francisco has the oldest buildings, with 90% built before 1980, while San Jose has significantly newer buildings overall, with only 56% built before 1980.

Low-income multifamily households do not appear to be greatly different regarding their energy-using equipment than multifamily households with adequate income. For instance, with respect to air conditioning (AC), 62% of low-income households have one or more room AC units or central AC. For multifamily households that are above 200% of the federal poverty guidelines, 63% have AC equipment. The most important factor determining whether multifamily households have AC equipment is not income but location: 98% of low-income multifamily households in Riverside have either room AC or central AC, whereas in San Francisco only 9% of low-income multifamily households have AC. The presence of central AC among low-income multifamily households is strongly related to the vintage of the building, with older buildings less likely to have central AC. Buildings smaller than 40 apartment units are less likely to have central AC than buildings that are larger (30% compared to 53%, respectively).

In the equipment used to heat the apartment, low-income multifamily households are more similar to other households' types in the same area than they are to other low-income multifamily households in other areas. In Riverside, 65% of households heat with a central furnace and air ducts; in San Jose, only 35% have central furnaces with another 35% having wall heaters and 18% using baseboard heaters or electric coils. Heating fuel does not vary much for multifamily households of all income levels on a statewide basis, but varies from one area to another. The percentage of low-income multifamily households using gas for space heating varies from 39% in San Diego to 63% in Anaheim.

Low-income multifamily households are only slightly less likely to report they have ENERGY STAR® qualified equipment than multifamily households with adequate income. For instance, 27% of low-income multifamily households say their refrigerator is ENERGY STAR qualified, compared to 33% of multifamily households with adequate income. The average age of the primary refrigerator does not differ between the two income groups either. While low-income multifamily households are less likely to have clothes washers, clothes dryers, or dishwashers in their units than are multifamily households with adequate income, the proportion of households reporting ENERGY STAR rated equipment is similar in the two sectors.

The split incentive barrier is well understood in the multifamily sector: where tenants pay for electricity and gas use, property owners derive less benefit from improvements in energy-efficiency. In the low-income sector, however, this barrier is somewhat attenuated. A greater proportion of households report that utility bills are paid by the property owner: 11% for electricity and 22% for gas. This compares to 6% and 18%, respectively, for multifamily households above 200% of the federal poverty guidelines. In San Francisco, moreover, 23% of low-income multifamily households report that electric utilities are included in their rent payment and 25% say gas is included. Among households for which energy utilities are separate from their rent payment, electric and gas utility costs consume about 4.5% of household income, on average. This utility burden, however, varies across the differing degrees of poverty. For households whose income brings them no higher than 50% of the federal poverty guidelines (about 40% of low-income households), utility costs consume nearly 29% of income, on average. At the other end of the spectrum, among households between 150% and 200% of poverty (about 20% of low-income households), utilities consumer about 3% of income.

Although our data do not allow us to develop great precision, making an assumption about the average rate at which low-income and adequate income multifamily households live together within buildings brings us to the estimate (shown in Table 4) of the number of buildings housing low-income multifamily households. Again, this is quite a rough estimate; but in concept it includes all buildings housing any low-income households. For example, this table shows that in PG&E's territory, there are an estimated 20,315 multifamily buildings housing low-income households that have five to nine apartment units. To arrive at this value we have had to make an assumption about the average rate at which low-income households mix with households with adequate income. For more detail on this assumption, see Section 3.

Table 4. Estimated Number of Buildings Housing Low-Income Multifamily Households

Building Size	PG&E	SCE	SDG&E	SCG
5 to 9 Units	20,315	18,113	6,331	31,714
10 to 19 Units	8,319	7,424	2,597	13,021
20 to 49 Units	3,298	2,915	1,018	5,107
50 or More Units	1,956	1,676	599	2,970
Total	**33,889**	**30,128**	**10,546**	**52,812**

2. Where are the low-income multifamily buildings located?

Cadmus estimated the number of low-income multifamily households in each California census tract, county, and utility territory. Low-income multifamily households are spread widely across the utility territories and in rather equal proportions: they constitute roughly 7% of households in PG&E's territory and 11% of households in SCG's territory, with proportions in SCE's and SDG&E's territories falling between those values.

Alpine and Mono counties have the highest proportion of low-income multifamily households, at about 22% and 16% of total households, respectively; but these are generally rural areas with few households of any kind. Otherwise, the highest proportions of low-income multifamily households are in urban counties—Los Angeles 14%, San Francisco 13%, San Diego 11%, Alameda 10%—or in agricultural areas such as Yolo County (13%) and Imperial County (10%).

3. In what ways is this segment being served through the existing ESA Program?

The existing ESA Program serves all low-income IOU customers, including single-family residences, multifamily residences, and mobile homes. The ESA Program provides income-qualified residents of multifamily buildings (along with single-family residences and mobile homes) with direct installation of retrofit measures to manage their energy use and save money on their monthly energy bills at no charge to the participating household. Unlike other IOU multifamily programs, the ESA Program focuses on serving households rather than building owners. Consistent with this approach, all of the services the program offers target the dwelling units of qualified households; the ESA Program does not treat central systems or common areas in multifamily buildings.

In 2012, the largest portion of the ESA Program's spending across all housing types went to installation of infiltration and space conditioning measures, including air sealing, duct sealing, and attic insulation. Lighting measures, primarily CFLs and interior CFL fixtures, provide the largest portion of the program's electric energy savings, and water heating measures such as low-flow faucet aerators and showerheads, pipe insulation, and water heater blankets provide the largest portion of the program's gas savings.

The ESA Program does not ostensibly distinguish services offered to multifamily and single-family residences. However, some differences exist in program delivery to owner-occupied units as opposed to renter-occupied units (which includes most multifamily properties). To provide some services to renters, the ESA Program requires building owners to sign a Property Owner Waiver form, authorizing efficiency improvements.[17] The program also requires building owners to provide a co-payment for the

[17] The Statewide ESA Policy and Procedures Manual states that, with written authorization from the IOU program manager, ESA contractors can install "services and measures that do not directly affect the condition and/or structure" of renter-occupied units without receiving a signed Property Owner Waiver form.

replacement of older, inefficient refrigerators in tenant units if the building owner owns the refrigerator and the tenant does not pay the electric bill, although ESA Program staff noted that both of these conditions rarely occur. The ESA Program provides refrigerator replacement at no cost to qualified owner-occupied households and renters who own their refrigerator or directly pay their electric bills.

The need to obtain a signed Property Owner Waiver form can be a barrier to participation, since some building owners are difficult to reach or unresponsive. To overcome this issue in the multifamily sector, the IOUs and ESA Program contractors have increased their outreach to the owners of buildings in low-income areas. Once ESA Program contractors gain the cooperation of a multifamily building owner, they seek access to the entire property so they can work through the building to enroll all eligible participants in multifamily rental units. As in single-family buildings, the ESA Program verifies the eligibility of multifamily households on a unit-by-unit basis prior to delivering services, although the program can also treat unoccupied units in a multifamily building once it has verified that at least 80% of the households are income-qualified.

The ESA Program does not offer any measures exclusively for multifamily buildings, nor does it explicitly exclude any measures from multifamily buildings, but fewer ESA Program measures are typically feasible to install in multifamily units than in single-family buildings. For example, multifamily units may have fewer exterior walls for air sealing, and multifamily units in multistory buildings may not have an attic that could be insulated. As a result, it may be more difficult for program contractors to meet the ESA Program requirement of installing at least three measures or achieving annual energy savings of at least 125 kWh or 25 therms through installation of one or two measures in multifamily units.

During the six-year period between 2007 and 2012, about 21% of low-income multifamily households in the utility territories participated in the ESA Program (formerly referred to as LIEE but referred to by IOU specific names to customer).[18] The distribution of measures installed varied by IOU.

1. ***Appliances:*** Of SCE MF participants, 18% received appliances (specifically, refrigerators). PG&E distributed microwave ovens to 1% of multifamily participants and refrigerators to 13% of multifamily participants.[19] At SDG&E, for example, 3% of participants received microwaves and 6% received refrigerators.
2. ***Envelope and Air Sealing:*** At PG&E and SDG&E, more than 70% of multifamily participants received measures in the categories of envelope and air sealing and domestic hot water. Among SCG ESA multifamily 5+ participants, more than 90% received envelope and air sealing measures.

[18] The ESA Program was formerly known as the Low-income Energy Efficiency (LIEE) Program.

[19] For PG&E, microwave ovens were offered through a limited pilot in in 2009-2010, and were not offered in 2011. Microwaves are back in the program starting 2013 as a regular PG&E ESA program measure.

3. ***Domestic Hot Water:*** Three-quarters or more of participating multifamily households received domestic hot water measures except among SCE's participants where, the prevalence of gas water heat makes the measure a less important source of electric savings.
4. ***Heating and Cooling:*** For all utilities, only a minority of multifamily households received HVAC measures, with about 11% of SDG&E households receiving heating measures and 14% of PG&E households receiving cooling measures.
5. ***Lighting:*** Most participating multifamily households in PG&E's and SDG&E's program received lighting measures. SCG did not distribute lighting measures because it is a gas only utility.

Table 5. Percentage of Participating Multifamily Households Receiving ESA Program Measures[1, 2]

Utility	Participants	Appliance	Envelope & Air Sealing	Domestic Hot Water	Heating	Cooling	Lighting
PG&E	58,877	14%	82%	84%	1%	14%	89%
SCE	65,775	18%	2%	0%	1%	1%	36%
SCG	64,510	0.1%	92%	98%	3%	0%	0%
SDG&E	32,670	14%	75%	73%	11%	2%	96%

1. Data is for PY2010 through PY2012
2. Percentages are of total MF households receiving measures during 2010 through 2012

4. Who is the multifamily customer: tenant or building owner?

The energy-efficiency services and incentives available to multifamily customers in California are divided between programs that view the tenant as the multifamily customer and programs that view the building owner as the multifamily customer.

Energy-efficiency programs offering common-area and central-system measures primarily target building owners, who have decision-making authority over these systems, while programs focused on in-unit measures are more likely to view the tenant as their customer. MFEER and the whole-building multifamily efficiency programs (including Energy Upgrade California multifamily (EUC MF) path and the REN programs) offer common-area and central-system measures, as well as in-unit measures. These programs target building owners.

The federally funded weatherization program that the California Department of Community Services and Development administers (CSD program)[20] takes both approaches. The program has reached out to, and worked with, owners of low-income multifamily properties to complete whole-building

[20] The CSD program receives funding through the U.S. Department of Energy's Weatherization Assistance Program as well as the U.S. Department of Health and Human Services' Low-income Home Energy Assistance Program.

weatherization projects,[21] but also allows multifamily households to qualify individually and provides in-unit measures to individually-qualified households.

The ESA Program and the CSD program primarily offer in-unit measures to individually-qualified households. They view the income-qualified tenant, rather than the building owner, as their customer. In part, these programs target income-qualified tenants because they seek to achieve goals beyond generating energy savings. Through the ESA Program, the IOUs seek to ensure that all ratepayers can benefit from ratepayer-funded efficiency program offerings by providing measures at no cost to customers who could not otherwise afford them.

A key reality faced by programs targeted to tenants is the amount of housing unit mobility among this sector. AHS data indicate that 54% of households had lived in their previous unit for three years or less. Thus, tenants receiving benefits are quite literally a moving target, with nothing to assure they will move into a unit that has been treated or that the household moving into the vacated unit would qualify for the program.

The ESA Programs' approach (serving low-income residents in mixed housing types) contrasts with that of the comparison low-income multifamily programs in other parts of the country that the research team examined. Like the ESA Program, these programs ultimately seek to benefit low-income households; however, the primary target of these programs is the owner of a multifamily building with low-income tenants. The comparison programs' focus on building owners is consistent with these programs' more comprehensive focus: in addition to measures in tenant units, these programs support upgrades to measures in common areas and central systems.

Obtaining benefits for the residents of the buildings served through these programs remains a priority, however. Comparison programs in Colorado and Massachusetts have formal requirements designed to ensure that the retrofits they support benefit tenants[22]. Both programs require building owners to agree not to raise rents for a defined period following the retrofit, and the program in Colorado further requires building owners to specify how they plan to use the cost savings from their efficiency improvements to benefit tenants.

Both the ESA Program and the CSD Program have increased their outreach to multifamily building owners in their efforts to target the low-income multifamily sector. The CSD program used budget increases resulting from ARRA funding to work directly with building owners to undertake whole-

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[21] As described below, to qualify for whole-building weatherization measures, CSD requires that 66% of the residents in a multifamily building be income qualified or that the building be listed on the list of qualified buildings maintained by the U.S. Department of Housing and Urban Development and the U.S. Department of Energy.

[22] Energy Outreach Colorado's Low-Income Multifamily Weatherization Program brings together funding from federal weatherization programs, utilities, and other sources. The LEAN Multifamily Program in Massachusetts is funded by utility ratepayers.

building retrofits in multifamily buildings with low-income tenants, but this level of support is unlikely to continue under the program's current, reduced budget.

The strategies for reaching out to the low-income multifamily sector that Decision 12-08-044 directs the IOUs to undertake approaches to serve multifamily housing with low-income tenants and will also require the ESA Program to work directly with multifamily building owners and managers. For example, efforts such as a whole-neighborhood approach and same-day enrollment, assessment, and installation require coordination with building owners and managers. The IOUs' proposed multifamily single point of contact will also direct building owners to the ESA Program, when applicable.

5. What is available (services and benefits) to the multifamily tenants and building owners now, via IOU or other programs?

Table 6 summarizes characteristics of the four statewide programs that most directly target the low-income multifamily sector. As described below, the programs listed include both programs targeting low-income tenants of multifamily buildings and programs targeting the owners and managers of multifamily buildings.

Table 6. Multifamily Program Characteristics

Program Characteristics	Programs Targeting Tenants		Programs Targeting Building Owners		
			MFEER	Whole Building	
	ESA Program	CSD Program		Bay REN	EUC MF Path and SoCal REN
Building Areas Treated	Dwelling units	Dwelling units Common areas[1] Central systems[1]	Dwelling units Common areas Central systems	Dwelling units Common areas Central systems	Dwelling unit Common areas Central systems
Typical retrofit scope	Lighting measures, hot water saving measures, weatherization, refrigerator replacement	Lighting measures, hot water saving measures, weatherization, refrigerator replacement	Single-measure upgrades: primarily lighting for PG&E, SCE, and SDG&E, water saving measures for SCG	Multiple measure upgrades	Comprehensive upgrades
Measure Identification	Walk-through assessment	Walk-through assessments and energy audits using diagnostic equipment	No standard protocol, contractor may conduct an assessment to determine scope of work	Building owner completes software-based assessment; technical assistance completes energy model and on-site verification	Investment grade audit
Incentive type	Direct installation[2]	Direct installation[2]	Prescriptive rebates[3] – may cover full cost to participant	Performance-based fixed per-unit incentive[4]	Performance-based tiered per-unit incentive[5]

1. While CSD individually-qualifies and treats tenant units, the program has also completed whole-building upgrades in buildings that meet its income qualification requirements.
2. In a direct installation program, the contractors who install measures work under contract to the program administrator. Direct installation programs typically provide measures at little or no cost to the participant.
3. Prescriptive rebates provide a set rebate amount for installation of specific measures.
4. Per-unit incentive amounts are based on the number of units in a participating building. The total incentive the building owner receives is the product of the per-unit incentive and the number of units in the building. For the Bay REN program, performance is assessed similarly to EUC MF programs, with a single minimum performance threshold of 10% whole building energy savings.
5. Performance-based incentives are based on project-specific energy savings estimates. These estimates depend on the pre-retrofit characteristics of the building or equipment, and may take into account factors including the actual duty cycle of the equipment and interactions between multiple measures.

The programs targeting building owners each focus on retrofits of different scopes and provide services consistent with that scope. For example, MFEER's single-measure retrofits are delivered primarily by contractors who use the program's incentives to sell retrofits to multifamily building owners. In contrast, IOU staff and contractors take a more active role in the EUC MF Path programs, as the single point of contact is expected to guide participants through a more complex retrofit process.

Taken together, the programs targeting multifamily buildings in California provide services to meet a wide range of customer needs. However, fully meeting the needs of an individual building owner, particularly in buildings serving low-income tenants, may require drawing on services from multiple programs. [23] Process evaluations of the ESA Program and MFEER, and IOU staff interviews suggest the coordination between programs has posed challenges in the past, particularly in coordinating between programs targeting tenants and those targeting building owners. The single point of contact proposed for the 2013-2014 program cycle and the more formal coordination process laid out in the EUC MF Path Program Implementation Plans (PIPs) seek to improve coordination between the programs serving the multifamily sector.

Responding to Commission direction in D. 12-11-015, in 2013, all of the IOUs planned to implement a single point of contact for multifamily building owners. This single point of contact will primarily work with building owners to determine which energy efficiency program offerings are most appropriate given the characteristics of the building and the types of upgrades the owner is interested in undertaking. The single point of contact will also assist building owners in navigating energy efficiency program participation processes and coordinating processes across programs. While the IOUs proposed the single point of contact as part of their EUC MF Path plans, and EUC MF Path participants will likely work most closely with the single point of contact, other programs serving the multifamily sector are expected to connect building owners with other programs, or with the single point of contact as appropriate.

The IOUs' EUC MF Path plans also describe a structured approach for the programs' coordination with the ESA Program. As part of their agreement to participate in the EUC MF Path, building owners will be required to authorize the ESA Program to serve their income-qualified tenants, and ESA Program contractors will qualify and treat all willing and eligible tenants. The participating building's energy use baseline will be calculated with the ESA Program's improvements in place to give credit to EUC MF for measures installed with ESA Program funding.

6. What do multifamily customers need from the IOU?

While we did not speak directly to low-income multifamily tenants, in our survey and comparative research we identified nothing to challenge or augment the fundamental premise of the ESA Program

[23] For example, a multifamily building owner may authorize ESA to serve units occupied by income-qualified tenants prior to installing additional measures and treating non-income-qualified units through MFEER or EUC MF Path.

that the chief need the IOUs can reasonably be expected to address is assistance in upgrading equipment and systems that consume energy. We found no mismatch between these needs and the ESA Program offerings. In our view, the primary challenge is in meeting these needs in the most efficient and effect manner possible.

To this end, the ESA Multifamily Financial Options Catalog, created for this research and discussed in Section 7, highlights the need for a single point of contact for multifamily building owners to facilitate their applications to any of the various financing opportunities that currently exist in the state of California. All 16 of the existing options we identified in this study are limited by different factors, such as geography, eligible measures, eligible applicants, and available funding. This can make it difficult for multifamily building owners and managers unfamiliar with the various options to identify the programs for which they might qualify, let alone make it difficult to navigate the application process. In addition, the tenant qualification process using different income guidelines can be disruptive to tenants, and place an administrative burden on property managers.

7. What are the barriers to serving multifamily customers?

The ESA Program must overcome a range of barriers in its efforts to serve low-income households, including customers' skepticism of the program's offer of free services, customers' inability to take time off of work to meet with program contractors, customers' difficulty providing the required documents, and cultural and language barriers. This study did not identify significant additional barriers that are unique to low-income residents of multifamily buildings. However, because nearly all low-income multifamily residents are renters, the need to obtain the property owners' permission to install some measures can pose a challenge to the ESA Program in reaching low-income tenants of multifamily buildings. Building owners may be hard to reach or unresponsive to ESA Program contractors, and may refuse participation for any number of reasons.[24]

Programs serving multifamily property owners and managers have encountered a range of barriers that prevent energy efficiency improvements. One barrier may stem from building owners' difficulty navigating the range of funding options available to provide the capital for energy efficiency retrofits. The Cadmus team's research on funding options available for multifamily building owners and tenants found that a number of options exist and that this market is rapidly changing.

In their 2013-2014 Program Implementation Plans (PIPs) for MFEER and the whole-building multifamily programs, the IOUs and Regional Energy Networks (RENs) cite a range of barriers to serving the multifamily property owners and managers who are these programs' participants. The low-income multifamily programs examined in other parts of the country also address the three barriers most commonly cited in the IOU and REN multifamily PIPs.

[24] These challenges apply to single-family renters as well as multifamily renters. As noted, they are relevant to the low-income multifamily sector specifically because 97% of low-income multifamily households are renters.

Table 7. Barriers to Serving Multifamily Building Owners and Managers

Barrier	California Program Approaches	Comparison Program Approaches[1]
Split Incentives: In many buildings, tenants pay the bills for energy used in dwelling units, and would thus benefit from energy savings. However, building owners maintain, replace, and upgrade energy-using equipment.	• Incentives cover full cost of some MFEER measures to building owner.[2] • Coordination with the ESA Program provides measures in qualified units at little or no cost to building owner.[3] • Marketing focus on non-energy benefits of upgrades to building owner.	• Fully subsidizing retrofits. • Outreach to public and non-profit-owned housing, where building owners are driven by missions that include providing benefits to tenants. • Marketing focus on non-energy benefits of upgrades to building owner.
Lack of awareness of energy efficiency: Building owners and managers may not be aware of opportunities to improve the efficiency of their buildings and may lack the information necessary to evaluate various retrofit options.	• Single point of contact will direct building owners to the most appropriate program and assist with participation process. • EUC MF Path participants undergo a comprehensive energy audit to identify savings opportunities.	• Comprehensive energy audits identify savings opportunities; comparison programs encourage building owner participation in this process. • One program provides more structured energy education to building owners/managers.
Lack of access to capital: Multifamily buildings often have tight operating margins and complicated financing structures, making it difficult for owners to provide capital for retrofits.	• Incentives provided to offset retrofit costs, in some cases covering most or all costs.	• Incentives provided to offset retrofit costs, typically covering 50%-100% of retrofit costs. • Programs offer financing or partner with a lender; program contacts advise building owners on financing options.

1. The five comparison programs examined are: CNT Energy's Energy Savers Multifamily Program, operating in the Chicago, IL area; NYSERDA's Multifamily Performance Program, operating in New York; Energy Outreach Colorado's Low-income Multifamily Weatherization Program, operating in Colorado; the LEAN Multifamily program operating in Massachusetts and administered by that state's gas and electric IOUs; and PSE&G's Residential Multifamily Housing Program, operating in New Jersey. Table 8, below, provides additional information about each program.
2. MFEER offers per-measure, prescriptive incentives. However, for some lighting retrofits and hot water saving measures these incentives cover the full retrofit cost, allowing participants to receive measures at no cost.
3. ESA provides measures at no cost to the low-income participant. However, in renter-occupied units, building owners may be required to provide a co-pay for replacement of refrigerators that are the property of the building owner, rather than the tenant, if the building owner pays the electric bill.

In interviews conducted for this study, building owners, managers, and advocacy groups expressed the desire to provide tenants with benefits offered by energy efficiency programs. However, respondents said concerns such as timing of upgrades, cost-effective measures, and limiting administrative time must remain a priority when considering participation in energy-efficiency programs. Additionally, analysis of the AHS data shows the average low-income multifamily household spends 4.5% of their income on energy costs, an average of $40 for electricity and $20 for gas. This relatively low energy burden may result in low motivation for the tenant to participate in the ESA Program, especially if barriers such as confusing paperwork or unwilling building owners are presented.

Managing multifamily buildings requires, at a minimum, long-term planning, financial commitment, technical expertise, organizational acumen, and significant administrative time. Add the perceived complexity of the various energy-efficiency programs, multiple measure types, and regulatory requirements to the mix, and multifamily building owner and manager participation in these programs can be inhibited.

Not surprisingly, the most prevalent theme to emerge from interviews with building owners, managers, and other stakeholders was the desire for IOUs to provide help in navigating the energy-efficiency programs, the offerings, the requirements, and funding sources. Respondents said they would also like technical expertise and administrative support from the programs.

8. How are other multifamily programs offered? What are their organizing principles?

The in-depth comparison of other multifamily programs offered in other states all included activities in five key areas expected to help achieve efficiency retrofits in low-income multifamily buildings: [25]

1. Supporting building owners through the retrofit process
2. Assessing energy-savings opportunities and developing a retrofit scope of work
3. Assisting with financing
4. Installing energy-efficiency measures
5. Ensuring the quality of installations and verifying energy savings.

Beyond these five key activity areas, the comparison programs were notable for the presence and role of nonprofit and public benefit organizations in both administering and delivering services to multifamily buildings. These organizations sought to identify buildings and work closely with owners to develop

[25] The programs selected for in-depth comparison operate in areas with climates very different from much of California. It is important to consider these differences in climate in comparisons of the energy savings accomplishments of the various programs and the cost effectiveness of the measures they offer. However, low-income tenants and multifamily building owners across the country likely face similar considerations in their decisions regarding energy efficiency. As a result, the comparison programs' established and well-documented approaches to reaching the low-income multifamily sector may provide insight into program delivery approaches that could be effective in California.

scopes of work that captured all cost effective opportunities. Several were able to facilitate or offer financing opportunities directly that further encouraged building representatives to take action.

As a whole, in the comparison programs, the priority was for a comprehensive treatment of the targeted buildings, with some programs covering substantial (if not all) of the retrofit costs. The wide range of costs per unit treated (and per multifamily unit) in a program's respective territories, illustrating the range of cost tolerance associated with reaching this challenging population. Most notable is the Multifamily Performance Program (MPP) of the New York State Energy Research and Development Authority (NYSERDA), which offers incentives to multifamily building owners based on the level of energy use reduction their retrofits achieve. Building owners can install any measure that building energy models show to be cost-effective. While the program is open to all multifamily buildings, those with qualified populations are able to access substantially higher incentives than market rate buildings progressing through the same program.

Broadly, the comparison programs approach the market with a facilitative, solution-oriented package. These programs provide access to detailed assessment information, feedback, and (in some cases) construction support. The audit is treated as an opportunity to identify all cost-effective upgrades and educate building owners.

Perhaps most importantly, the materials for several programs articulated a long-term commitment to this market by: (1) describing expectations such as building the skills of contractors and technical partners, (2) documenting the non-energy benefits associated with energy-efficiency upgrades, and (3) locking in financial benefits for the residents of treated buildings. Table 8 provides a brief summary of the approaches taken by each comparison program.

Table 8: Summary of Comparison Program Approaches

Administrator	Program Name	Service Area	Broad Approach	Description
CNT Energy	Energy Savers Multifamily Program	Chicago metro area	Partnership + case management	CNT Energy staff work closely with participating buildings to guide them through the retrofit process and manage their participation in applicable efficiency programs offered by utilities.
NYSERDA	Multifamily Performance Program	New York State	Facilitation + performance	Participants in NYSERDA's MPP work with a consulting engineer ("partner") who guides them through the retrofit process, including identifying financing offerings and overseeing contractor selection and measure installation. The program pays incentives based on the energy savings a building achieves, with higher incentives offered to buildings housing low-income tenants.

Administrator	Program Name	Service Area	Broad Approach	Description
Energy Outreach Colorado	Low-income Multifamily Weatherization Program	Colorado	Clearinghouse + general contractor	EOC brings multiple funding sources together to form a single program targeting the low-income multifamily sector. EOC works as a general contractor for program participants during the retrofit process, defining a scope of work and contracting with installers.
Massachusetts gas and electric IOUs	Low-income Energy Affordability Network (LEAN) Multifamily Program	Massachusetts	Gatekeeper + full service	LEAN provides participating building owners with WegoWise benchmarking software in order to identify those with the greatest potential for retrofits. LEAN covers the full cost of retrofits for buildings participating in the program.
Public Service Electric & Gas Company (PSE&G)	Residential Multifamily Housing Program	Central New Jersey	All comers + financing	PSE&G's program does not have explicit income requirements, although the program recruits the majority of its participants through its partnership with the New Jersey Housing and Mortgage Finance Authority, which serves low-income housing providers. The program offers on-bill financing to cover the cost of retrofits not paid for by incentives.

Section 3. California Multifamily Housing Data Relevant for Low-Income Customer Programs

Distribution of Low-Income Multifamily Housing in California

Summary of Key Findings

Using data from the American Community Survey and GIS technology, we estimated the number of low-income multifamily households in California and apportioned those households by IOU service territory, by county, and by census tract. Cadmus calculated the percentage of households that: (1) meet the ESA Program low-income criterion of earning less than or equal to 200% of the federal poverty guideline (defined by the U.S. Census Bureau), and (2) resided in buildings with five or more units. The result is our estimate of the size of the targeted low-income multifamily sector.

For details about the methodology, see Appendix C.

Appendix D details the methodology used to determine the characteristics of low-income multifamily housing.

Appendix E details the methodology used to estimate the penetration of ESA Program and MFEER penetration into the low-income multifamily sector.

Appendix J summarizes measures installed in multifamily households through the ESA Program by each of the four IOUs, referenced in Section 3 of this report.

Table 9 shows Cadmus' estimated population statistics for each of the IOUs. Where relevant, we present separate figures for electricity and gas territories. To estimate the number of gas customers we adjusted the number of households by the proportion that receive gas service. We made these adjustments using data from the 2011 American Housing Survey (AHS) Public Use File, described more fully below and in Appendix C. Where more than one utility serves the same household, that household is represented in both rows of the table.

Table 9. Estimated Population Statistics for California IOUs

Utility Fuel	Population	Housing Units	Households	Low-Income Households	Multifamily Households	Low-Income Multifamily Households
PG&E Electric	12,202,249	4,676,014	4,263,939	1,175,083	790,156	313,050
PG&E Gas	11,266,960	4,370,507	3,992,141	1,090,934	744,293	303,475
PG&E Combined	14,405,709	5,520,242	5,042,422	1,418,408	921,301	377,015
SCE Electric	13,047,504	4,498,850	4,115,093	1,239,688	789,022	335,484
SDG&E	3,345,594	1,275,178	1,169,705	302,148	308,055	116,904

Utility Fuel	Population	Housing Units	Households	Low-Income Households	Multifamily Households	Low-Income Multifamily Households
Electric						
SDG&E Gas	2,385,014	904,483	829,106	223,603	226,262	87,800
SDG&E Combined	3,345,594	1,275,178	1,169,705	301,947	308,055	116,904
SCG Gas	17,185,501	6,009,618	5,523,378	1,773,469	1,344,630	591,929

Source: U.S. Census Bureau American Community Survey 2011 and Athens Research

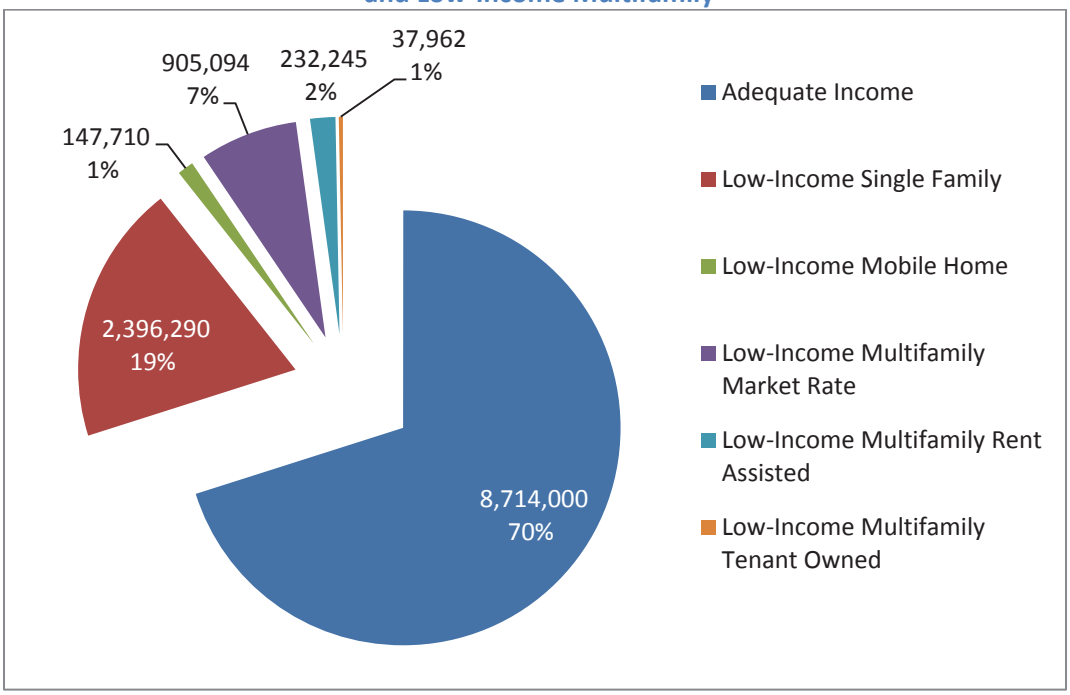
It is important to note that the estimates of low-income multifamily households in Table 9 represent occupied residential units and exclude group quarters such as dormitories and prisons. Moreover, the count of households is lower than the number of active service connections to the IOU, as some households have more than one connection. As a point of comparison with our estimates, PG&E estimates 5.768 million total residential customers, which is 4% higher than our estimate of housing units and 14% higher than our estimate of households. Our estimate of low-income households was arrived at using a different methodology than the other statistics. For those, we applied an estimate of the percentage of low-income households by county, produced by Athens Research, to the ACS estimate of total households. PG&E estimates 1.758 million low income customers, which is 24% higher than our estimate. For a discussion of our methods, see Appendix C.

Statewide, low-income multifamily households in buildings with five or more units represent approximately 9% of total residential households, 32% of low-income households, and 42% of multifamily households, for a total of 1.175 million households.[26] Note, however, that the percent of multifamily households within the low-income sector varies across IOUs, ranging from 39% to 27%. Based on 2011 American Housing Survey data, discussed below, approximately 20% of low-income multifamily households live in housing units that are government subsidized. This represents about 230,000 households.

Figure 3 shows the estimated number of households in California by income category and housing type.

[26] Table 9 includes some double counting of households, because some households are served by two of the utilities.

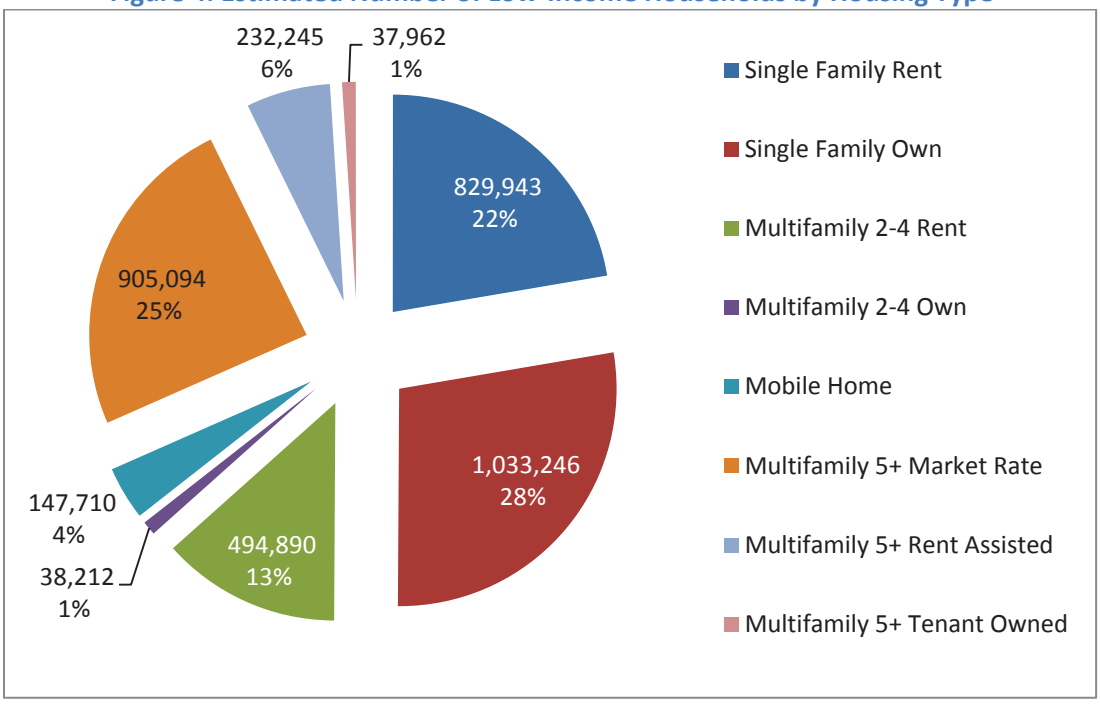
Figure 3. Estimated Number of California Households Including Low-income and Low-Income Multifamily



Source: 2011 American Community Survey and 2011 American Housing Survey

In Figure 4, the low-income households in California are apportioned in eight categories of building type and ownership status. About 32% of low-income households live in housing that is categorized as multifamily housing by the ESA program, including buildings with five units or more.

Figure 4. Estimated Number of Low-Income Households by Housing Type



Source: 2011 American Community Survey and 2011 American Housing Survey

Population statistics for California counties are presented in Appendix C. Also in that appendix is a comparison of frequencies obtained in the current study with findings from the 2009 Residential Appliance Saturation Survey (RASS) and with an estimate produced by Athens Research intended to estimate the number of customers eligible for the CARE rate.

Characteristics of Low-Income Multifamily Housing in California

Summary of Key Findings

Cadmus' characterization of low-income multifamily housing in California is derived primarily from the 2011 American Housing Survey (AHS) Public Use File. The AHS is sponsored by the Department of Housing and Urban Development (HUD) and conducted by the U.S. Census Bureau. These data provide much greater detail about housing characteristics than are found in the ACS and, thus, provide a key source of information about the circumstances of our target class of households, the low-Income Multifamily Sector or LIMF.

The data Cadmus used are organized into Metropolitan Statistical Areas (MSAs). The 2011 AHS survey identifies eight MSAs in California: Anaheim, Los Angeles, Oakland, Riverside, Sacramento, San Diego, San Francisco, and San Jose (see Housing for a map of these MSAs.) Table 10 shows the MSAs used for this analysis and the corresponding counties. Maps of the MSAs superimposed onto the utility electric and gas territories are included in Appendix D.

Table 10. California MSAs in the 2011 AHS Data and Corresponding Counties

MSA Name	Counties
Anaheim	Orange
Los Angeles	Los Angeles
Oakland	Alameda, Contra Costa
Sacramento	El Dorado, Placer, Sacramento, Yolo
Riverside	Riverside, San Bernardino
San Diego	San Diego
San Francisco	Marin, San Francisco, San Mateo
San Jose	San Benito, Santa Clara

Because the data do not include all customers of the IOUs, we do not contend that the data reflect either the absolute numbers of all multifamily or the subset of low-income multifamily households. For instance, neither Fresno nor Stockton, both large Central Valley communities with high percentages of low-income qualifying customers, are represented by an MSA. Nevertheless, we consider the relative percentages of low-income multifamily units to be important indicators of the sector as a whole and especially of relatively urban areas.

The MSAs included in the 2011 AHS survey encompasses a large proportion of utility customers. Table 11 shows the estimated number and percentage of utility households and low-income households included within the eight AHS MSAs.[27]

Table 11. Estimated IOU Population Included within AHS MSAs

Utility/Fuel	MSA Households	Total Households	MSA Low-Income Households	Total Low-Income Households
PG&E Electric	4,263,939	53%	1,175,083	42%
PG&E Gas	4,756,266	61%	1,299,746	51%
PG&E Combined	5,185,236	56%	1,458,581	46%
SCE Electric	4,115,093	87%	1,239,688	87%
SDG&E Electric	1,169,705	100%	302,148	100%
SDG&E Gas	1,064,048	100%	286,965	100%
SDG&E Combined	1,169,705	100%	301,947	100%
SCG Gas	6,167,353	86%	1,980,239	86%

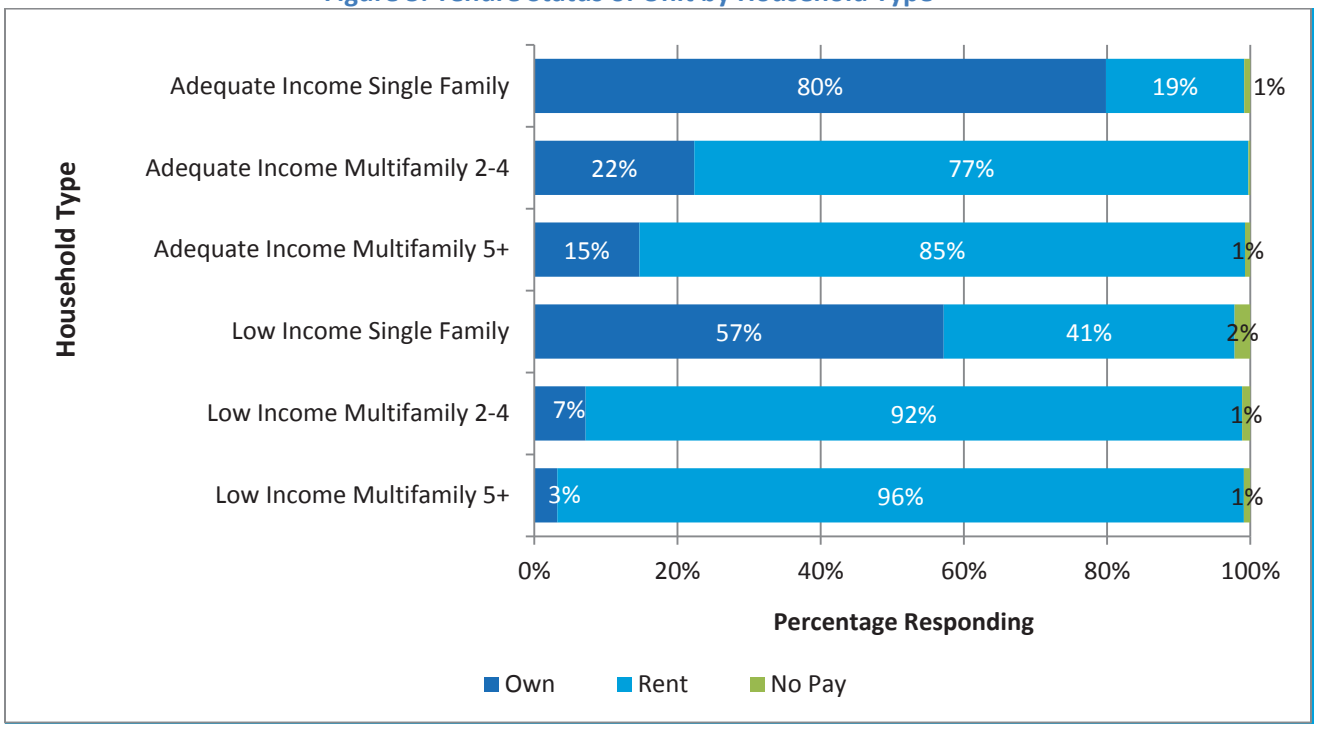
Source: U.S. Census Bureau American Housing Survey 2011 and Athens Research

[27] The household percentages were estimated using county-level data provided by John Peterson at Athens Research. MSAs are contiguous with county boundaries. Athens provided the number of utility customers in each county and we calculated the proportion of total customers in counties within the MSA boundaries.

Tenure

"Tenure" is the term used by the Census Bureau to characterize whether members of a household own or rent the unit they inhabit. Figure 5 shows the tenure status for each of the six household types. The percentage of householders who own the property they inhabit is higher for single-family units than for multifamily units, regardless of income status. Still, for each building structure, low-income households are less likely to own their residence than households with adequate income.

Figure 5. Tenure Status of Unit by Household Type



Source: U.S. Census Bureau American Housing Survey 2011

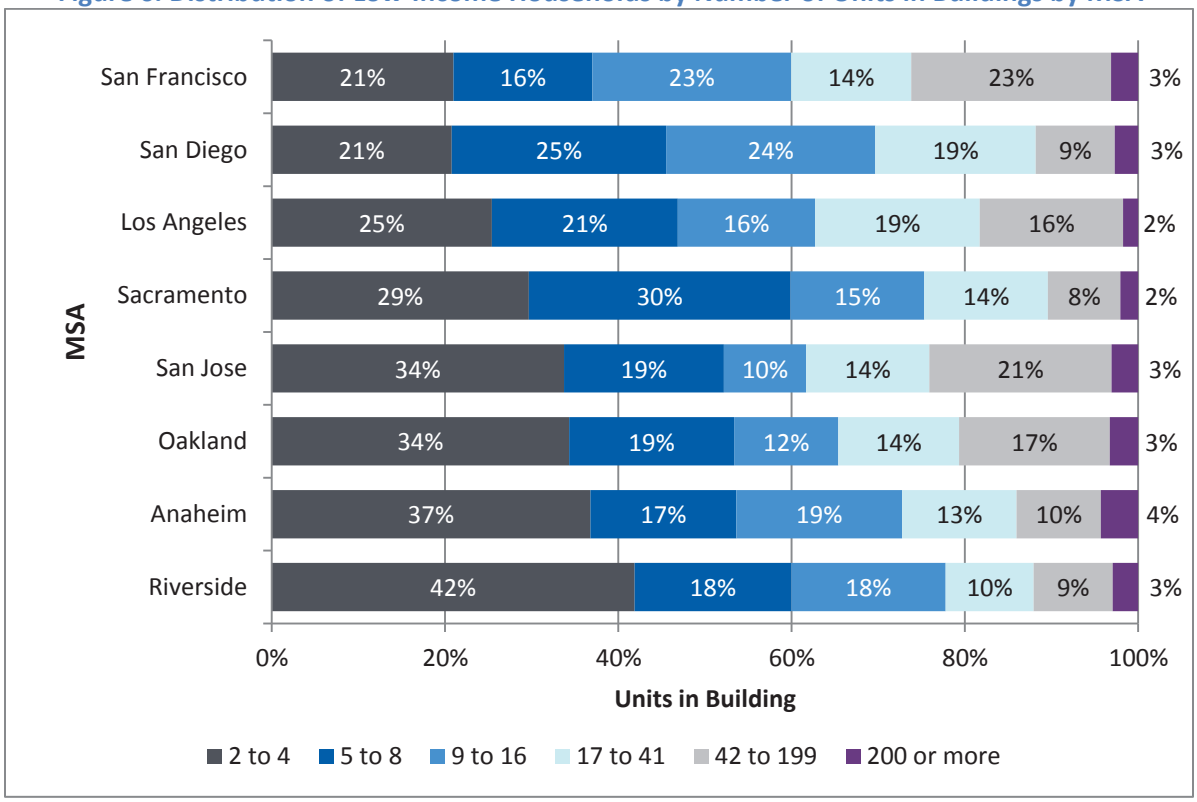
Building Characteristics

The number of units in the building in which low-income multifamily households live is shown in Figure 6.[28] For comparison purposes, we have included households living in buildings with between two and four units, although these are not defined as multifamily properties by the ESA Program. The MFEER program does define these two-to-four unit building as multifamily properties although EUC MF does not. San Francisco has the highest percentage of low-income households living in large buildings of 42

[28] The categories shown represent the quartiles of building size for buildings with five units or more, across the eight MSAs, with the upper quartile is split so that the category "200 or more" units represents the top 5% of all buildings. Thus, approximately 25% of all low-income multifamily households live in buildings of 5 to 8 units, 25% live in buildings of 9 to 16 units, 25% live in buildings of 17 to 41 units, and 25% live in buildings with 42 units or more.

units or more (26%). Conversely, Sacramento has the largest percentage of households living in buildings with only 5 to 8 units (30%).

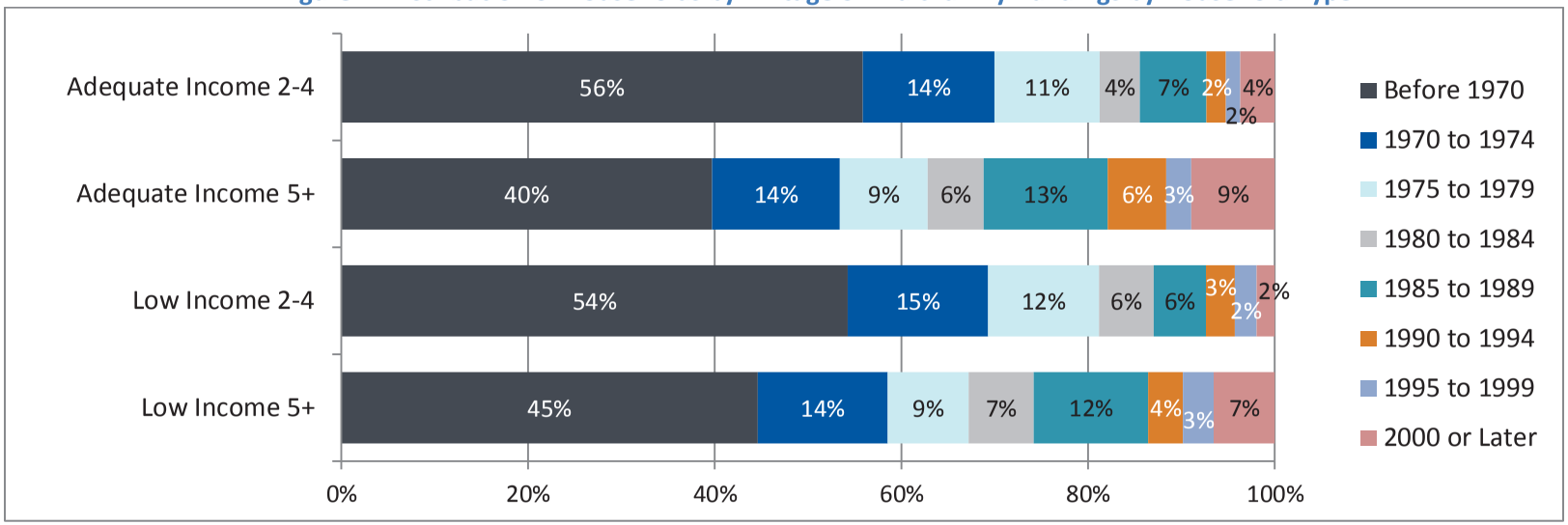
Figure 6. Distribution of Low-Income Households by Number of Units in Buildings by MSA



Source: U.S. Census Bureau American Housing Survey 2011

Figure 7 shows the distribution of multifamily households by vintage of the building they inhabit, by household type. Buildings with two to four units are somewhat older, on average, than buildings with five or more units, regardless of the income of the household living in them. Nearly 70% of low-income multifamily households in five or more unit buildings live in buildings built before 1980. For the smaller two-to-four unit buildings, the percentage is even higher, at more than 80%.

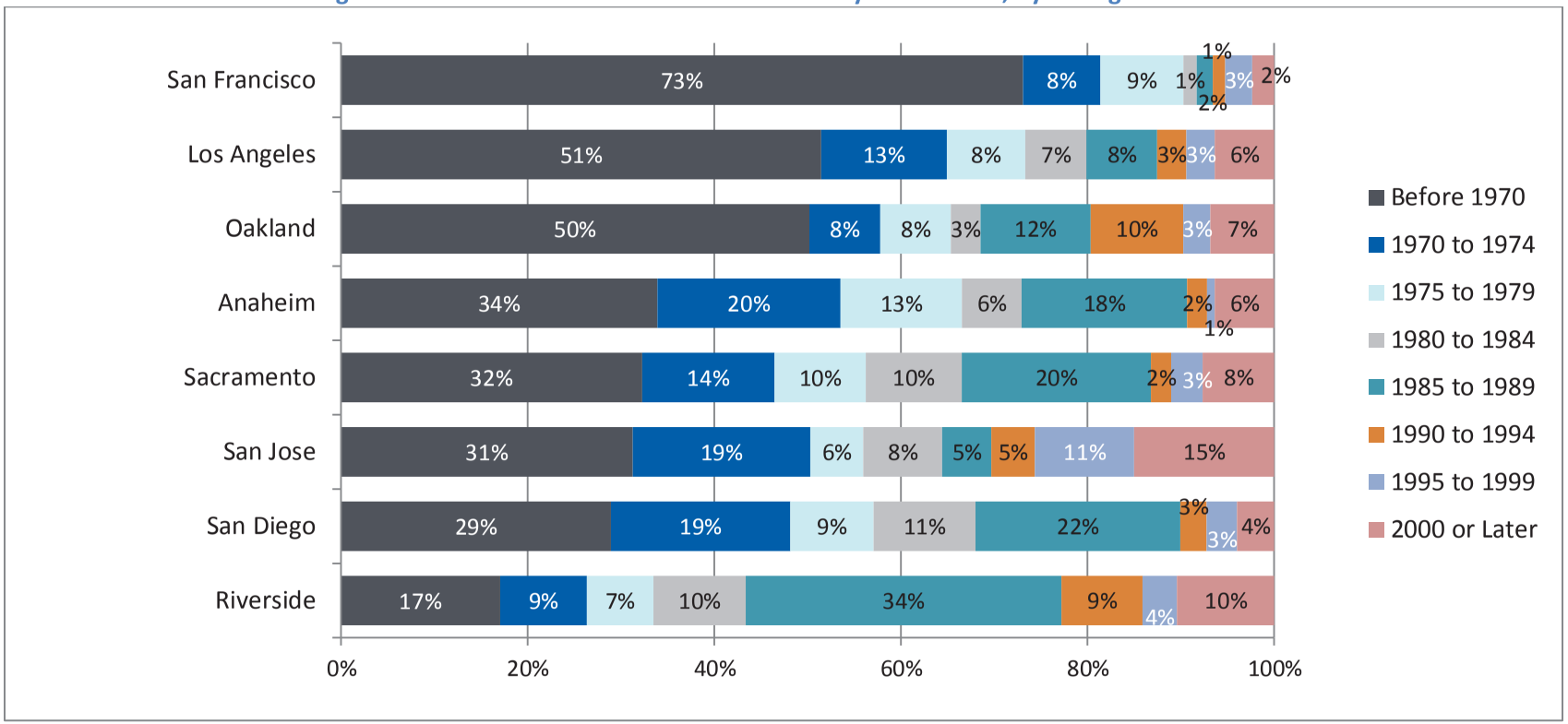
Figure 7. Distribution of Households by Vintage of Multifamily Buildings by Household Type



Source: U.S. Census Bureau American Housing Survey 2011

Figure 8 shows the distribution of low-income multifamily households in buildings with five or more units, by the vintage of the building they inhabit and by MSA. Low-income multifamily households in San Francisco inhabit in the oldest buildings, on average, with 90% living in buildings built before 1980. In southern California, outside of Los Angeles County, there is a bulge in the distribution for housing built between 1985 and 1989.

Figure 8. Distribution of Low-Income Multifamily Households, by Vintage and MSA



Source: U.S. Census Bureau American Housing Survey 2011

The 68% of low-income multifamily households living in units built before 1980 represent approximately 766,000 households. This is the segment most likely to benefit from shell improvements, though buildings of later vintage may also benefit and some of these pre-1980 units may have already received shell upgrades.

Benefits are larger in climate zones with greater cooling and heating loads. The California IOUs have approximately 160,000 low-income multifamily customers in California climate zones 11 through 16, all of which have relatively large heating and especially cooling needs. Buildings in these areas also tend to be of more recent vintage. As shown in Figure 8 the percentages low-income households living in pre-1980 multifamily buildings in Riverside (33%) and Sacramento (56%) serve as the basis of a blended estimate that there are about 160,000 x 0.495 = 79,200 low-income multifamily households living in high-need climate zones within buildings in likely need of shell improvement. Based on utility measure costs of between $104 and $202 per unit for envelope and air sealing measures, it would cost $12.1 million to serve this number of households.

Unit Characteristics

Table 12 shows the number of occupants, bedrooms, and rooms for both low-income and adequate-income households living in multifamily buildings having five or more units. The data in this table are sorted according to number of occupants in the low-income units. Although low-income units do not consistently have fewer bedrooms or rooms, low-income households across all MSAs tend to have more occupants than do households with adequate income.

Table 12. Occupancy Characteristics of Multifamily Households (5+ Units) by MSA and Income Status

MSA	Number of Occupants		Number of Bedrooms		Number of Rooms	
	Low-Income	Adequate Income	Low-Income	Adequate Income	Low-income	Adequate Income
Anaheim	2.8	2.1	1.6	1.6	3.9	3.8
Riverside	2.7	2.0	1.6	1.6	3.9	3.8
San Diego	2.6	2.0	1.6	1.6	3.8	3.8
Sacramento	2.1	1.8	1.5	1.7	3.7	4.0
Oakland	2.2	1.8	1.5	1.5	3.7	3.7
Los Angeles	2.5	1.9	1.5	1.6	3.6	3.9
San Jose	2.3	2.2	1.4	1.7	3.6	3.9
San Francisco	2.3	1.8	1.2	1.3	3.1	3.5

Source: U.S. Census Bureau American Housing Survey 2011

In buildings having five or more units, the low-income units are generally smaller (in terms of overall square footage) than the adequate-income units. The only exception to this generalization occurs in the MSA of Oakland. Table 13 shows the total square footage of low- and adequate-income multifamily units.

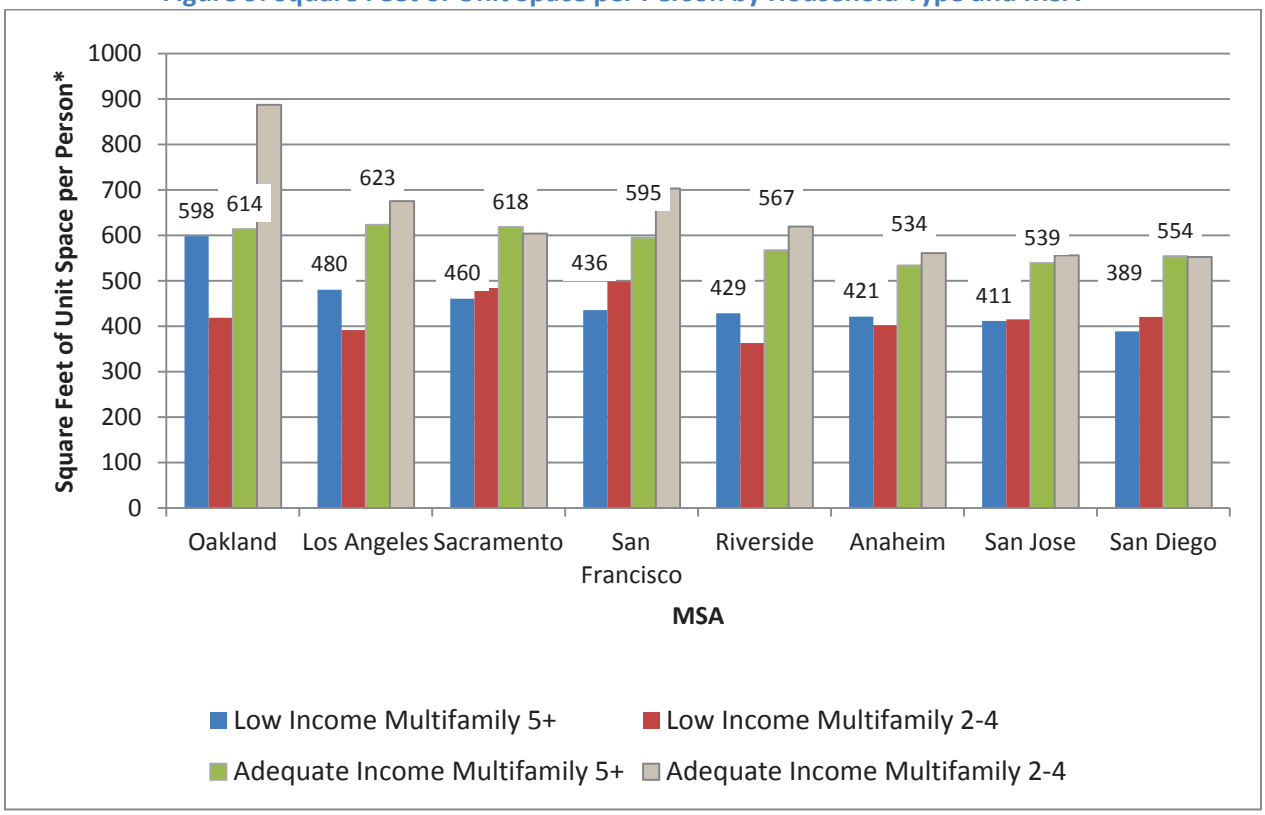
Table 13. Square Feet of Unit Space in Multifamily Buildings by Income, Number of Units and MSA

MSA	Total Square Feet			
	Low-Income (2-4 units)	Adequate Income (2-4 units)	Low-Income (5+ units)	Adequate Income (5+ units)
Oakland	932	1,493	993	873
Riverside	814	927	842	900
Anaheim	924	1,001	829	901
Los Angeles	807	1,093	788	978
San Diego	823	995	783	896
San Jose	833	1,032	712	916
Sacramento	899	905	710	898
San Francisco	959	1,280	704	885

Source: U.S. Census Bureau American Housing Survey 2011

For four types of multifamily households, Figure 9 shows the average square feet of unit space per person. Considering that low-income multifamily households have more occupants than do adequate-income households, the size of units per person clearly shows the effect of income status on living space. Across the eight California MSAs, the square feet of unit space per person in low-income households in buildings having five or more units is less than that of adequate-income households in the same building types. To highlight the contrast, our graphic contains the values of low-income and adequate-income households living in apartments having five or more units.

Figure 9. Square Feet of Unit Space per Person by Household Type and MSA*



Source: U.S. Census Bureau American Housing Survey 2011

* The values shown are the numbers of low-income (dark blue leftmost bar) and adequate-income (the green bar third from left) households living in apartments having five or more units.

Rent and Rent Subsidy

Table 14 shows the average rent paid per bedroom for both low- and adequate-income multifamily households in buildings having five or more units. (This is sorted by rent for low-income units.)

To simplify comparison across unit sizes, we divided the total rent amount by the number of bedrooms, as that is a large component of total cost. The 2011 rents for these low-income households range from a low of $552 (Riverside) to a high of $812 (San Jose) per bedroom. Again, Oakland is an interesting anomaly, as it has among the lowest rent-per-bedroom for low-income households, but it has the third highest rent-per-bedroom for adequate-income households.

Table 14. Average Monthly Rent and Rent Paid per Bedroom (Multifamily 5+ Unit Buildings)[1]

MSA	Monthly Rent		Rent per Bedroom	
	Low-Income	Adequate Income	Low-Income	Adequate Income
Anaheim	$1,197	$1,331	$788	$957
San Jose	$1,097	$1,631	$812	$1,091
San Diego	$957	$1,212	$635	$826
Los Angeles	$907	$1,390	$646	$964
San Francisco	$898	$1,580	$694	$1,266
Oakland	$841	$1,226	$594	$982
Riverside	$813	$987	$552	$671

Source: U.S. Census Bureau American Housing Survey 2011

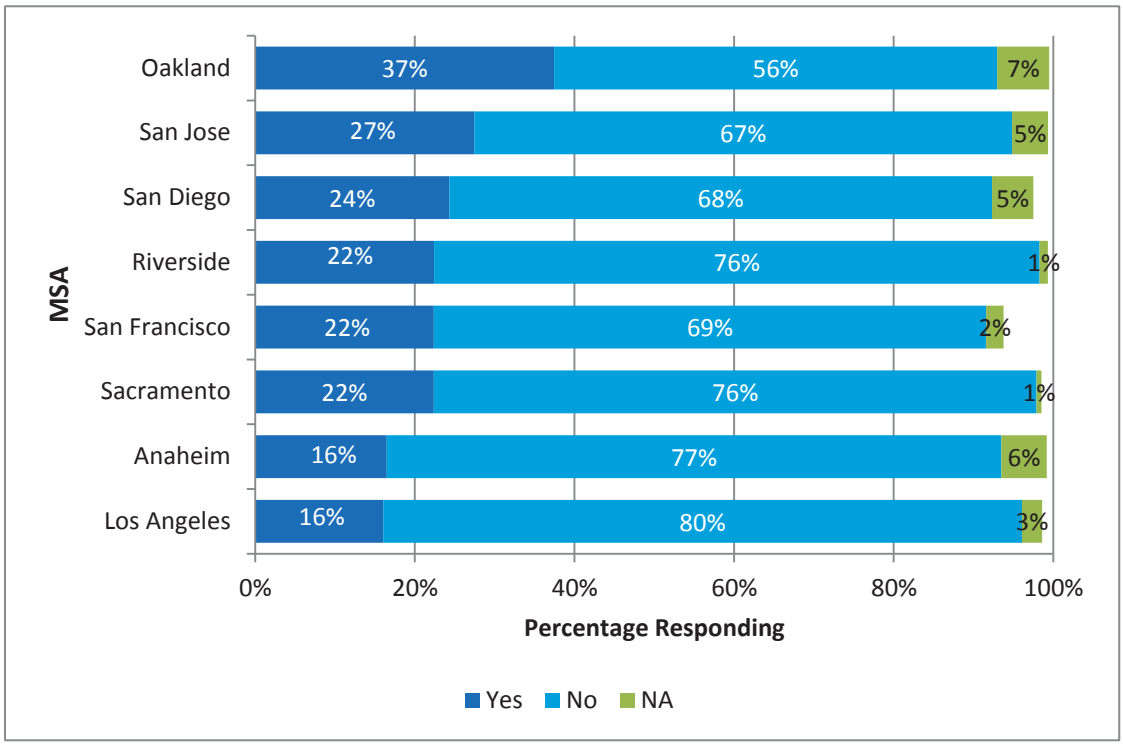
1. The AHS item is: "How much is the rent?"

Some low-income households receive direct assistance in the form of government subsidies for paying their rent. AHS documentation indicates that data on rent subsidies are not based on government or local records but on self-reported responses. The respondent is asked, "Does the Federal, State, or local government pay some of the cost of the unit?" with several follow-up items to verify the response. AHS documentation notes that the data are *"subject to the ability of a respondent to properly classify the unit as public or private and, if private, as subsidized or nonsubsidized housing…Subsidized housing…includes state and local programs as well as federal and need not be low-income housing."*[29]

For buildings having five or more units, the percentage of low-income multifamily units for which the rent is government-subsidized is shown in Figure 10. Oakland has the highest proportion (37%), and Los Angeles and Anaheim each have less than half that. We note that Anaheim has among the highest rents for this class of households. The response "NA" represents respondents who occupy a housing unit without paying rent, either because they own the unit or because they are staying in a unit they do not own without paying rent. This does not include households living in public housing.

[29] U.S. Department of Housing & Urban Development, Office of Policy Development & Research. March 2013. "Codebook for the American Housing Survey, Public Use File: 1997-2011." p. 534

Figure 10. Percentage of Units with Government Subsidized Rents for Low-Income Multifamily (5+ Units)



Source: U.S. Census Bureau American Housing Survey 2011

Equipment in Existing Units

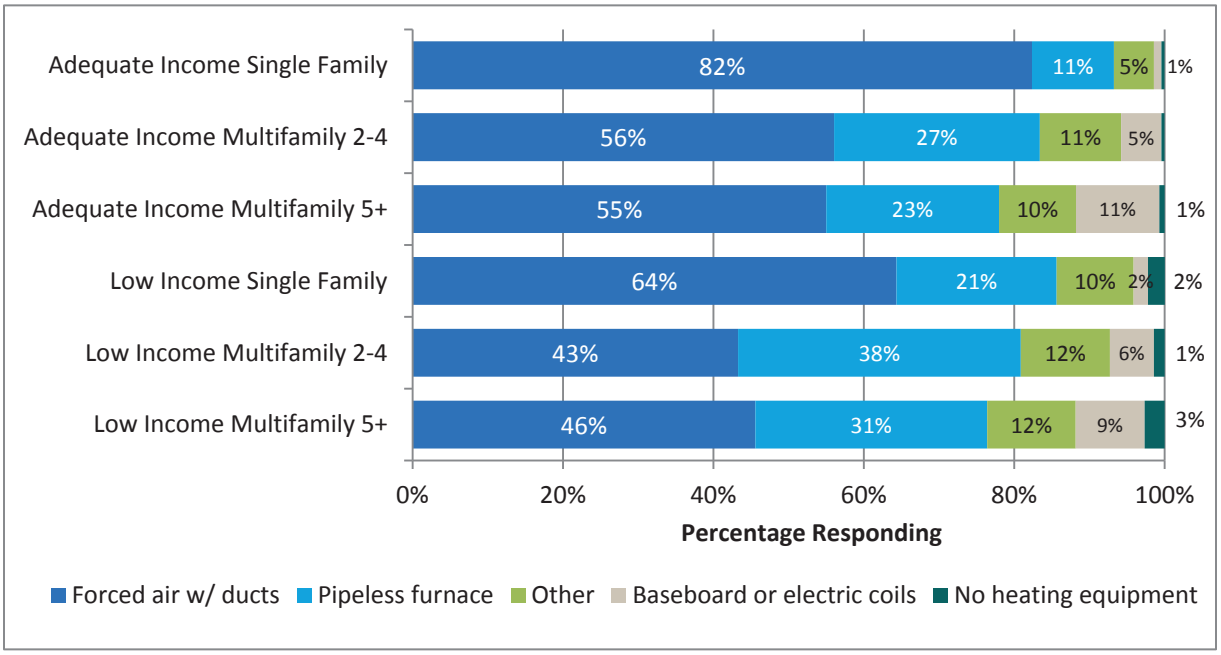
The AHS provides information about energy-using equipment installed in housing units. In this section we report data related to heating and cooling as well as major appliances. The AHS does not collect data on the vintage of equipment, which is an important piece of information in determining the need for efficiency upgrades. To get an estimate of equipment vintage, we used the 2009 Residential Energy Consumption Survey (RECS) conducted for the U.S. Energy Information Administration.[30] This survey is based on a smaller sample than the AHS, and thus cannot provide the resolution needed to identify low-income multifamily households within the State of California. Rather, the estimates we derive are for the Western Census Region, which includes California, Oregon, and Washington. Nevertheless, they provide a reasonable estimate of equipment vintage for California to the extent that California households are not substantially different than those in other states with respect to equipment vintage.

[30] U.S. Energy Information Administration. 2009. *Residential Energy Consumption Survey.* http://www.eia.gov/consumption/residential/

Heating Equipment

Figure 11 shows the most common heating equipment used by building type. In buildings having five or more units, low-income multifamily households use fewer forced-air systems (46%) than do adequate-income households (55%). Pipeless furnaces seem to account for this difference, comprising 31% of low-income multifamily households but just 23% of adequate-income households in these buildings.[31]

Figure 11. Heating Equipment Use by Household Type



Source: U.S. Census Bureau American Housing Survey 2011

Figure 12 shows the most common heating equipment used in multifamily buildings having five or more units. Organized by MSA, this information reveals that:

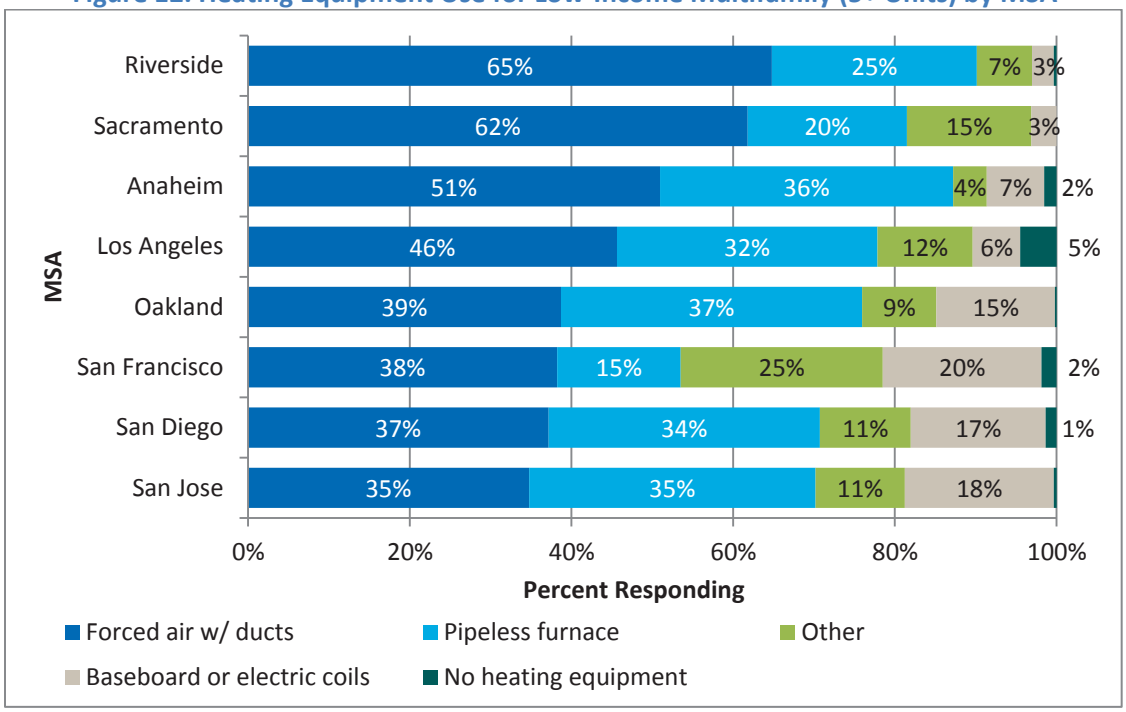
- Low-income households in Riverside and Sacramento use the highest proportion of forced-air heating.
- Baseboard or electric coils comprise more than 15% of the heating equipment used in San Francisco (20%), San Jose (18%), San Diego (17%), and Oakland (15%).

San Francisco uses a sizeable amount of "other" heating equipment (25%), which includes radiators or other steam system (20%) and vented kerosene, gas, or oil (4%). The category of "Other" heating types for Figure 12 encompasses radiators and other hot water or steam systems, electric heat pumps, vented

[31] "A 'floor, wall, or other ***pipeless*** furnace or built-in hot air heater without ducts' delivers warm air to the room right above the furnace or to the room(s) on one or both sides of the wall in which the furnace is installed." See: U.S. Department of Housing & Urban Development, Office of Policy Development & Research. March 2013. "Codebook for the American Housing Survey, Public Use File: 1997-2011," p. 148.

room heaters burning kerosene, gas, or oil, and portable electric heaters used as main heating sources. Approximately 12% of low-income multifamily households use portable electric heaters as supplemental heat. This is a lower rate of use than for households in other categories, which use portable electric heaters as supplemental heat in about 17% of households.

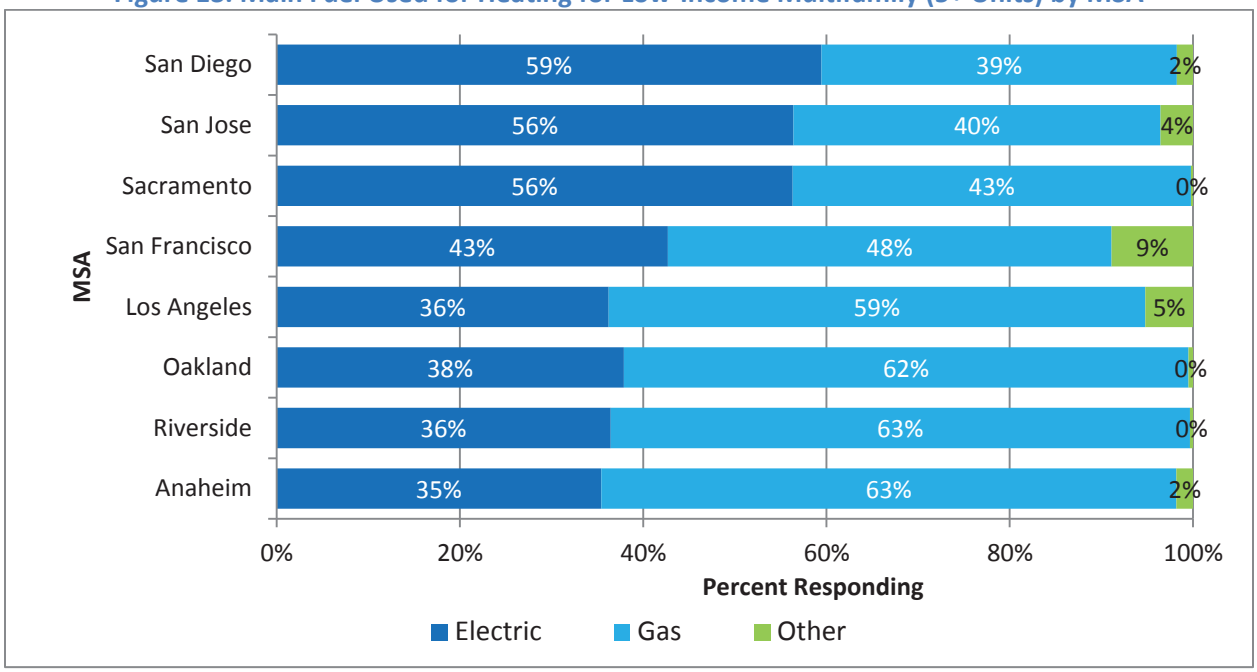
Figure 12. Heating Equipment Use for Low-Income Multifamily (5+ Units) by MSA



Source: U.S. Census Bureau American Housing Survey 2011

Electricity is a more common heating fuel in the multifamily sector—regardless of household income—than in other sectors. About 42% of low-income multifamily households use electricity as their main heating fuel, compared to 22% in 2 to 4 unit low-income multifamily and 22% in single-family low-income multifamily. The relative share of electric heat varies considerably for the low-income portion of the multifamily sector across MSAs, however. This is shown in Figure 13. The response "other" includes households that do not have heating equipment and, in San Francisco, 5% of low-income multifamily households that are heated with fuel oil.

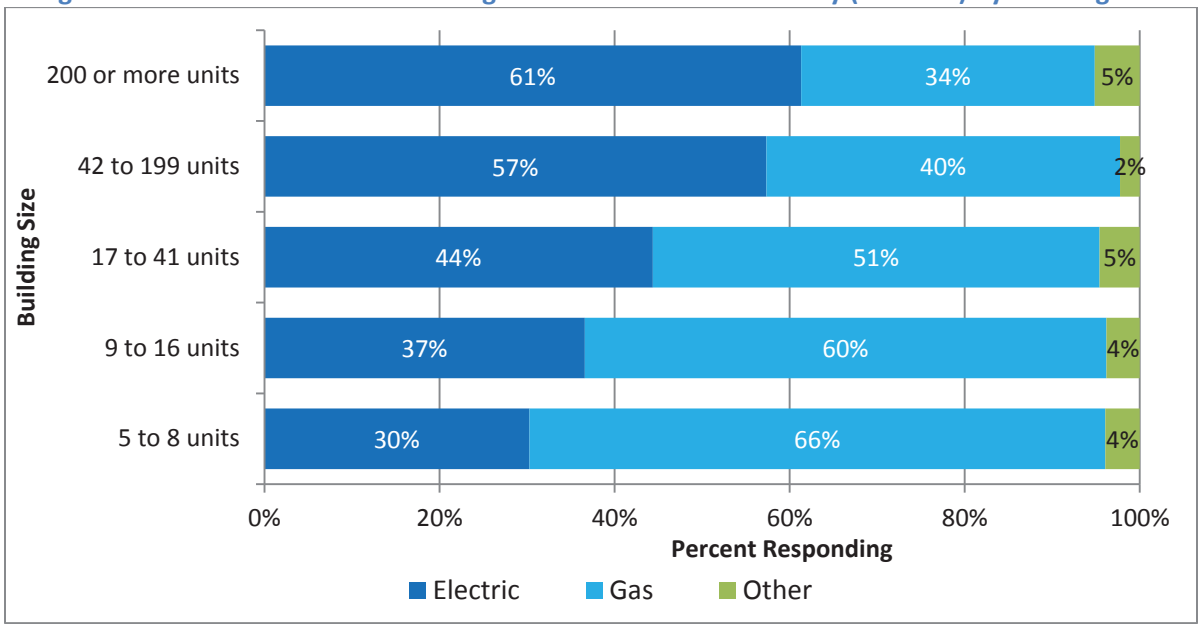
Figure 13. Main Fuel Used for Heating for Low-Income Multifamily (5+ Units) by MSA



Source: U.S. Census Bureau American Housing Survey 2011

The proportion of low-income multifamily households that use electricity as the main heating fuel also varies greatly by the size of the building and the vintage of the building in which the household resides. Figure 14 shows the main heating fuel of low-income multifamily households by building size. As the size of the building increases, the share of households heated by electricity increases substantially.

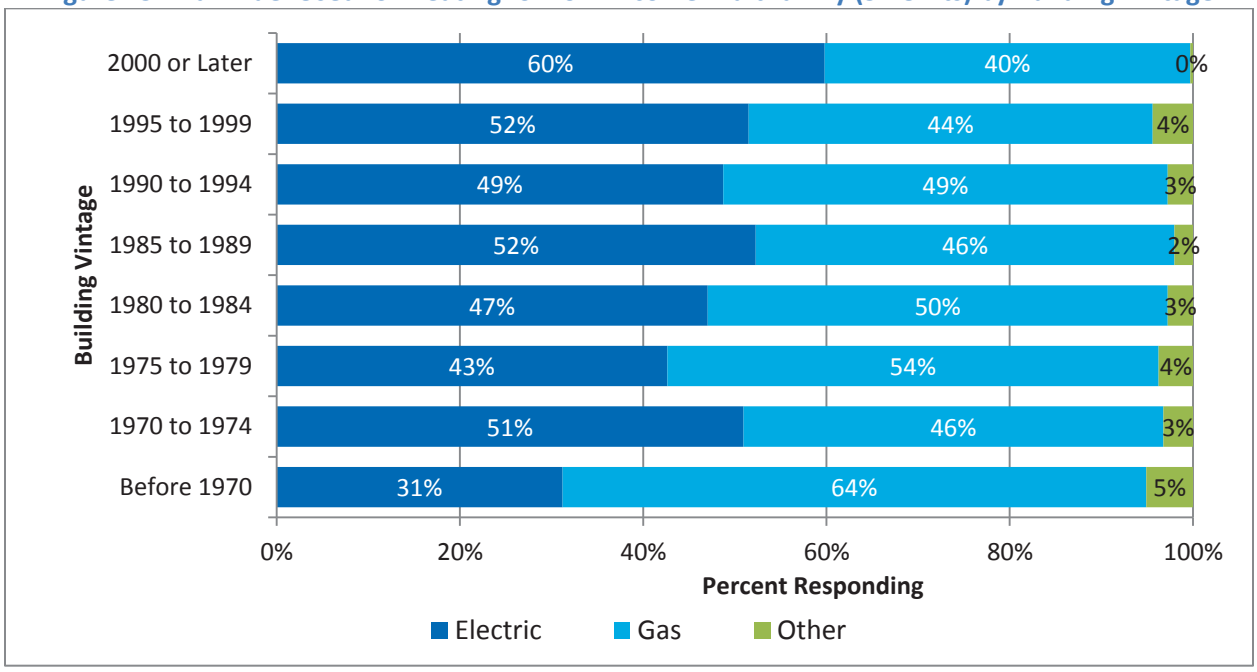
Figure 14. Main Fuel Used for Heating for Low-Income Multifamily (5+ Units) by Building Size



Source: U.S. Census Bureau American Housing Survey 2011

Figure 15 shows the main heating fuel of low-income multifamily households by building vintage. There is a tendency for newer buildings to use electricity in higher proportion than older buildings, though there is an anomalous bump in electric heating among buildings built between 1970 and 1974.

Figure 15. Main Fuel Used for Heating for Low-Income Multifamily (5+ Units) by Building Vintage



Source: U.S. Census Bureau American Housing Survey 2011

For an estimate of equipment vintage, we used results of the 2009 RECS. Those data indicate that, for the Western Census Region, among low-income multifamily households, 40% of households have heating equipment that is 20 years old or older. Those proportions are not equivalent by heating fuel type, however. Forty-nine percent of low-income multifamily households with gas heat have equipment that is 20 years old or older; only 32% of low-income multifamily households with electric heat have equipment as old as 20 years or more.

Looking at building vintages, another pattern emerges. In buildings built in 1960 or before, 37% of low-income multifamily households have heating equipment that is 20 years old or older. Many of these buildings have had equipment replaced in the lifetime of the building. In buildings built after 1960 and before 1991, 55% of households live in buildings with heating equipment older than 20 years.

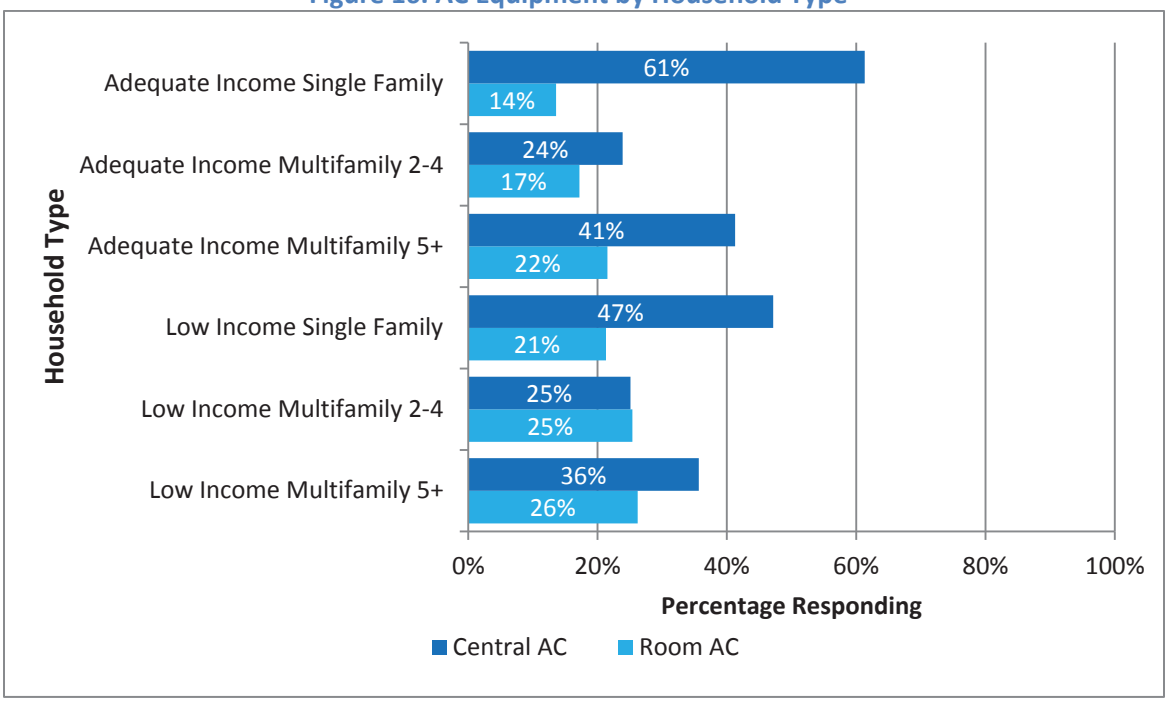
Figuring that 77% of low-income multifamily households have either forced-air furnaces or pipeless wall furnaces, and that 40% of households have heating equipment that is 20 years old or older, about 347,000 households among the IOU's low-income multifamily customers are estimated to have heating equipment that is 20 years old or older. Of these, approximately 207,000 are forced air furnace systems and 140,000 are pipeless wall furnaces. It is difficult to accurately assess the number of *systems* represented among households with forced air systems because these furnaces can serve numerous households. We estimated an average of 10 households per building housing low-income multifamily

households. This implies that the 207,000 households with forced air furnace equipment at the end of its effective useful life reside within about 21,000 buildings. Based on DEER modeling and cost estimates, we calculate the average replacement cost for a multifamily forced-air furnace as $7,828.[32] We estimate the incremental equipment cost as $1,736. Thus, full replacement cost for 21,000 units would be $164.4 million, and the incremental equipment cost would be $36.5 million.

Cooling Equipment

Figure 16 shows the percentage of respondents, organized by household type, who have central air conditioning or room air conditioning. (Note that these data are only from customers living within the eight MSAs in the 2011 AHS survey and not the hot Central Valley communities of Fresno or Stockton, which are in PG&E's service territory.)

Figure 16. AC Equipment by Household Type*



Source: U.S. Census Bureau American Housing Survey 2011

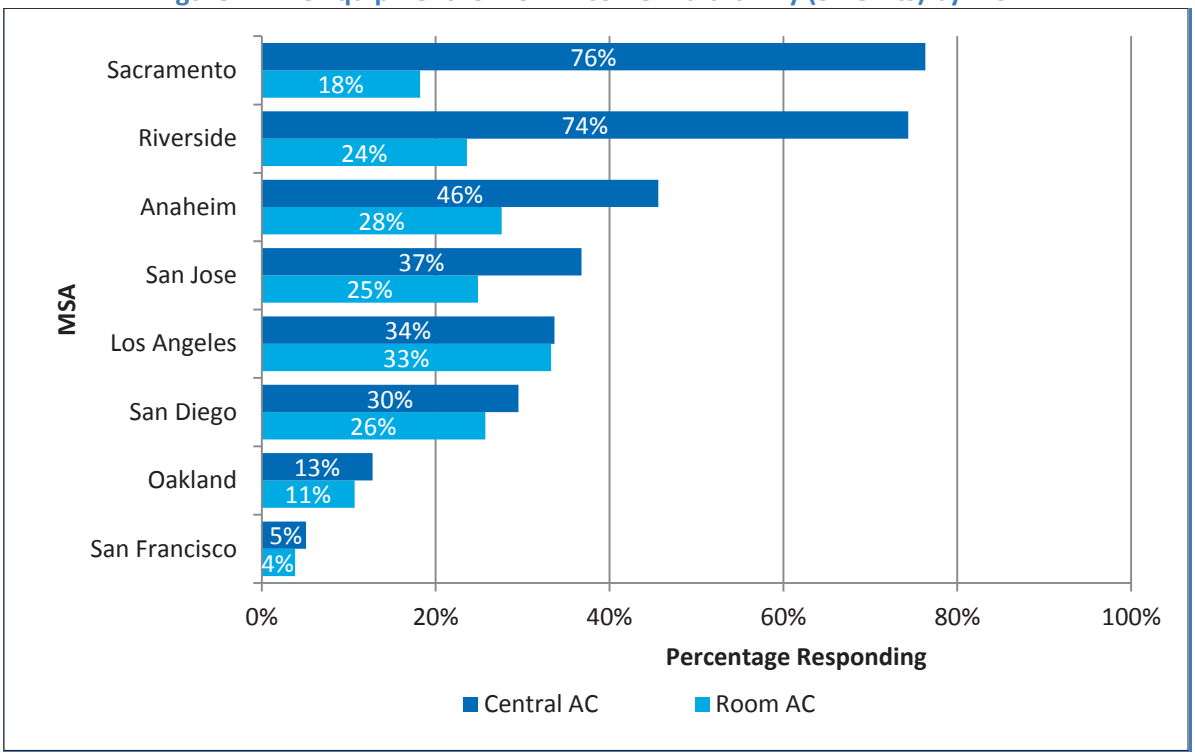
* Figure shows the percentage of total households that have either room or central AC.

[32] Using average heating capacity (378 kBtu) for multifamily buildings (based on the Itron report, "2005 DEER Residential Prototype Characteristics Workbook"), we estimated the average full and incremental costs for replacing existing equipment with an AFUE 90% furnace. Incremental costs are relative to a baseline 80% AFUE furnace. Cost data come from the 2008 DEER database, which is the most recent DEER data on equipment costs. We blended DEER values by climate zone, weighted by the number of low-income multifamily utility customers living within each climate zone, using data for apartments build before 1978.

While the differences across types are not dramatic, single-family units are more likely to have central AC regardless of income. Among households living in multifamily buildings with five or more units, low-income households are only slightly less likely than adequate-income households to have AC, but the equipment mix is different (more room AC and less central AC).

Not surprisingly, a strong factor in determining whether low-income multifamily households have AC is the climate in which they reside. Among low-income households living in multifamily building with five or more units, the incidence of AC equipment varies widely by MSA. Figure 17 shows the percentage of low-income multifamily households in buildings with five or more units that have either room AC or CAC.

Figure 17. AC Equipment for Low-Income Multifamily (5+ Units) by MSA*



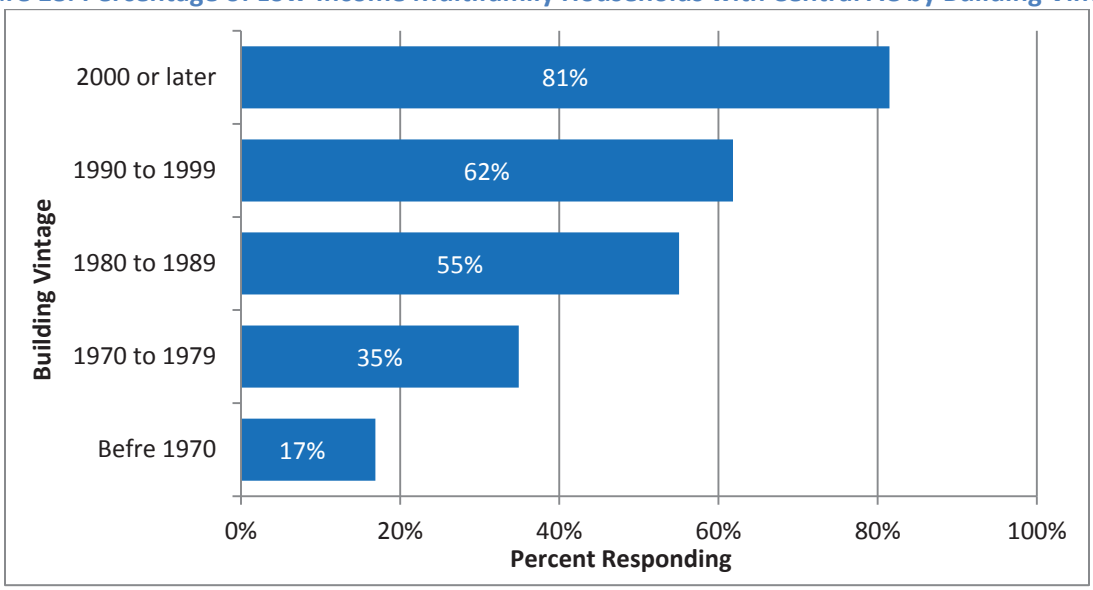
Source: U.S. Census Bureau American Housing Survey 2011

* Figure shows the percentage of total households that have either room or central AC.

Central AC use exceeds room AC use by more than 10% in the following MSAs: Sacramento, Riverside, Anaheim, and San Jose. Los Angeles and San Diego each exhibit smaller differences between room AC and central AC use. Oakland and San Francisco have relatively little AC use, due to the cooler Bay Area climate.

Having a central AC system is strongly correlated with the age of the building, as shown in Figure 18. Among low-income multifamily households, 81% percent of buildings that were built since 2000 have central AC. In buildings built between 1990 and 2000, 62% have central AC. Only 17% of buildings built before 1970, however, have central AC.

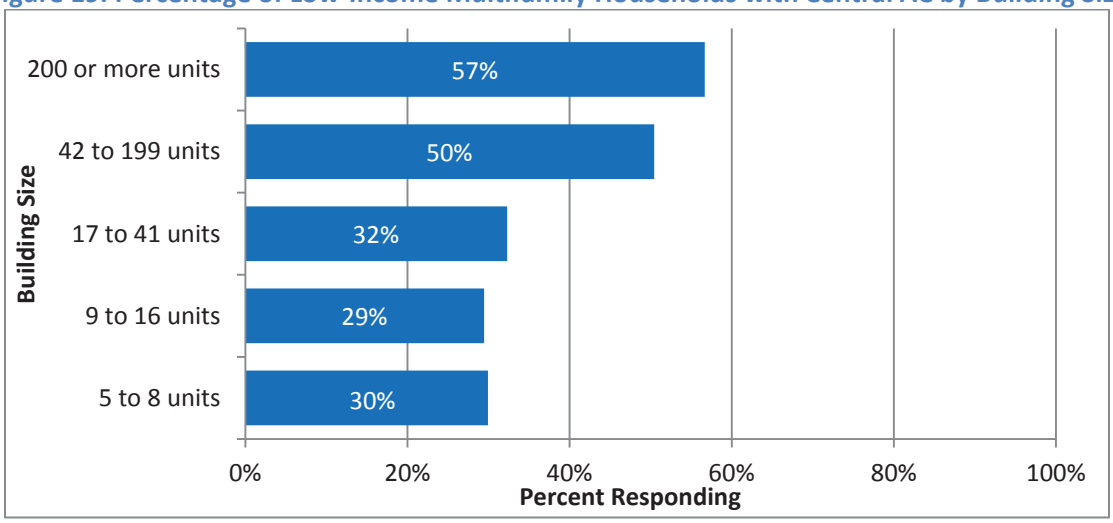
Figure 18. Percentage of Low-Income Multifamily Households with Central AC by Building Vintage



Source: U.S. Census Bureau American Housing Survey 2011

Larger buildings are also more likely to have central AC. Figure 19 shows that central AC is most common in the largest two quintiles of building size (that is, buildings having more than 42 units).

Figure 19. Percentage of Low-Income Multifamily Households with Central AC by Building Size

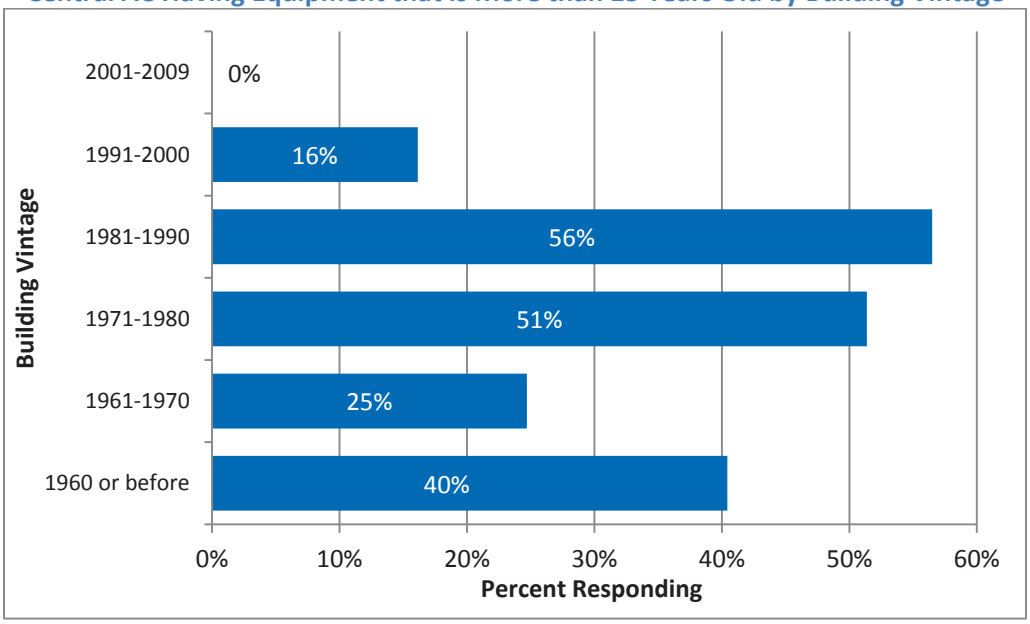


Source: U.S. Census Bureau American Housing Survey 2011

For an estimate of equipment vintage, we again used results of the 2009 RECS. Those data indicate that, for the Western Census Region, among low-income multifamily households in buildings with five or more units and *that have central AC equipment*, 34% of households have AC units that are 15 years old or older, with 28% having equipment that is 20 years or older. We note that this is nearly the same percentage found among multifamily households with adequate income (35% > 15 years old; 24% > 20 years old).

Considering building vintage, we can see the effects of equipment life on the proportion of older central AC units. As Figure 20 shows, significant numbers of buildings built in 1960 or before have equipment that is aging, having gone through two and possibly three replacement cycles. Buildings built between 1961 and 1970 are at a lower point in the replacement cycle. The highest percentage of older equipment is in buildings build between 1971 and 1990.

Figure 20. Percentage of Low-Income Multifamily Households with Central AC Having Equipment that is More than 15 Years Old by Building Vintage



Source: Energy Information Administration 2009 RECS Survey

Combining the estimate that 36% of low-income multifamily households have central AC, with the estimate that 28% of households have central AC equipment that is 20 years old or older, implies that about 118,500 *households* are cooled by central AC equipment that is 20 years old or older.

If the analysis is narrowed to only climate zones where energy savings are greatest from AC upgrades, our estimate of the number of central AC units at the end of their useful lives is reduced. For instance, PG&E only provides AC tune-ups and replacement in climate zones 11, 12, and 13. There are about 120,000 low-income multifamily households in these climate zones that are PG&E customers. If, as in the Sacramento MSA (see Figure 17), about 75% of households have central AC, and if 28% of those households have equipment that is 20 years old or older, then approximately 25,200 households in

these climate zones are cooled by central AC equipment that is 20 years old or older. SCE has provided AC tune-ups and replacement primarily in climate zones 14 and 15, in which they have approximately 28,000 low-income multifamily customers. Applying the proportion of central AC equipment from Figure 17 for the Riverside MSA, 74%, and the region-wide of equipment that is 20 years old or older, we estimate 5,800 multifamily households are cooled by central AC equipment that is 20 years old or older. SCG and SDG&E did not replace central AC equipment.

In PY 2012, only SCE replaced central AC systems or compressors in multifamily households through the ESA program, replacing either the condenser or the package at 61, for an average unit cost of about $4,000.[33] Thus, very roughly, the full cost to replace all PG&E low-income multifamily units 20 years old or older would be $101 million, with a cost of $23 million to replace all SCE units. The incremental cost to replace these units, on the other hand, assuming an average unit size of three tons, we estimate to be $714.[34] Thus, if the program covered only the incremental material cost, the cost to upgrade all units would be $18.0 million for PG&E and $4.1 million for SCE.

Appliances

The AHS captures the percentage of ENERGY STAR rated appliances compared to regular efficiency appliances. Figure 21 shows both the saturation of major measures and the proportion of each that low-income multifamily households report are ENERGY STAR qualified. In this figure, the total length of each bar represents the saturation of the equipment in low-income multifamily households. Each bar is divided into the proportion of households that has Energy Star qualified equipment, the proportion that does not have this equipment, and the proportion that does not know. Twenty-eight percent (27%) of low-income multifamily households *that have a refrigerator* report they have an ENERGY STAR qualified unit. Ninety-nine percent of households have a refrigerator. The percentage of ENERGY STAR equipment is similar for clothes washers (among households that have a clothes washer, 27% are ENERGY STAR), room AC (among households that have room AC, 25% are ENERGY STAR), and dishwashers (21% are ENERGY STAR in the households that have dishwashers).

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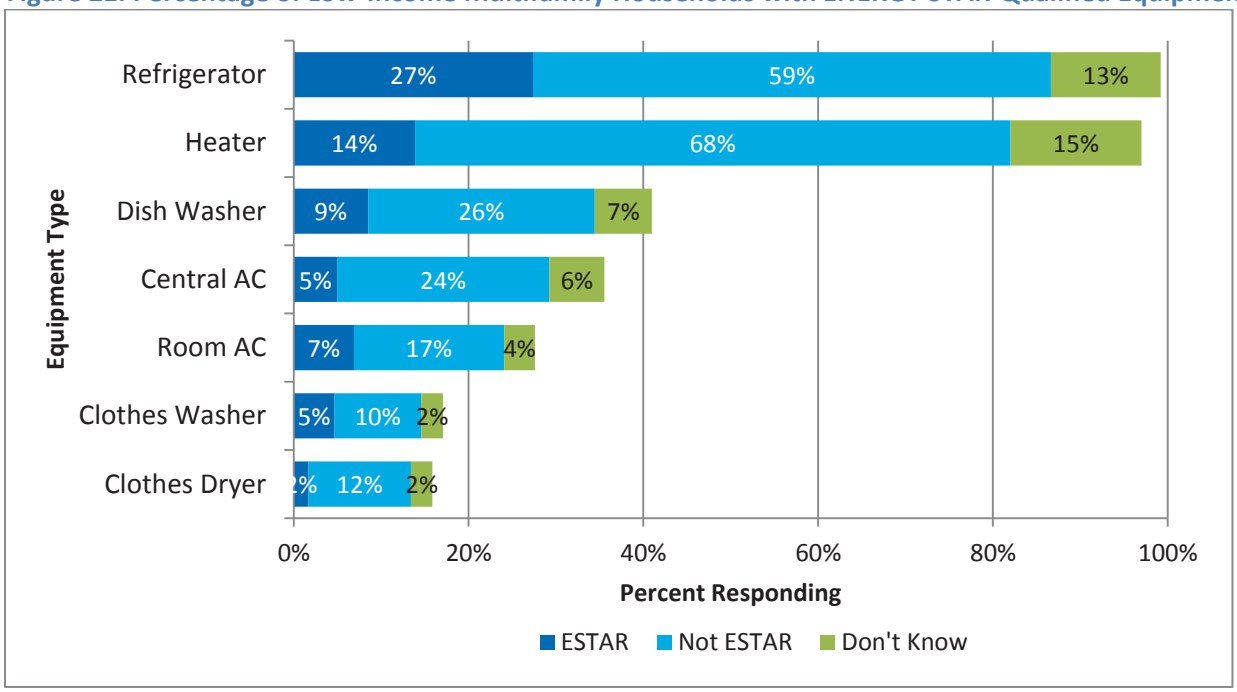
[33] Based on a communication with the ESA program manager at SCE. Cost includes equipment and installation as well as duct testing and sealing.

[34] 2008 DEER database, the incremental cost of installing a SEER 14 unit instead of a SEER 13 unit: Measure Material Cost Case ID D08-RE-HV-ResAC-S15, Base Case -Code/Standard Cost Case ID ResAC-13p0seer. Incremental material cost = $238 per ton.

Figure 21. Percentage of Low-Income Multifamily Households with ENERGY STAR-Qualified Equipment



Source: U.S. Census Bureau American Housing Survey 2011

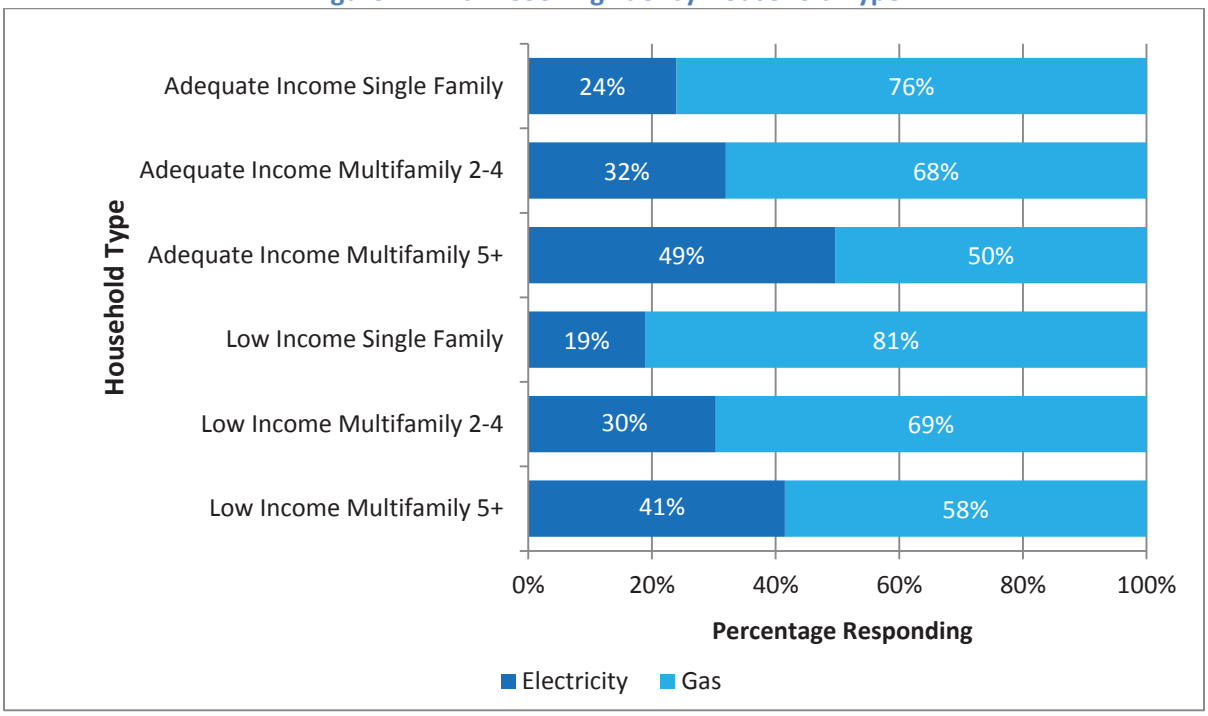
The 2009 RECS data indicate that for the Western Census Region, among low-income multifamily households, about 27% of refrigerators 10 years old or older, with 8% that are 15 years old or older. This compares to 24% of refrigerators 10 years old or older among multifamily households with adequate income, with 8% that are 15 years old or older. Applying these percentages to the number of low-income multifamily households, we estimate that roughly 94,000 low-income multifamily households have refrigerators 15 years old or older.

Based on ESA program measure costs for PY 2012 it costs between $574 and $856 to replace a refrigerator through the program. Using the average price of $717, it would cost $67 million to replace all refrigerators that are 15 years old or older. The survey conducted by Cadmus, results of which are reported in Section 4, found that about 23% of low-income multifamily households own their own refrigerator. If this proportion is applied to the number of old units, the resulting 21,620 units would cost about $15.5 million to replace. In PY 2012, PG&E replaced 2,046 refrigerators in multifamily households through the ESA program; SCE replaced 3,097 and SCG&E replaced 340.

Fuel Use

In California's eight MSAs, multifamily households are more likely than single-family households to use electricity as the main cooking fuel. However, low-income multifamily households with five or more units are more likely to use gas for the main cooking fuel (58%) than are adequate-income multifamily households with five or more units (50%). Figure 22 provides a comparison of the main cooking fuel used by the different household types.

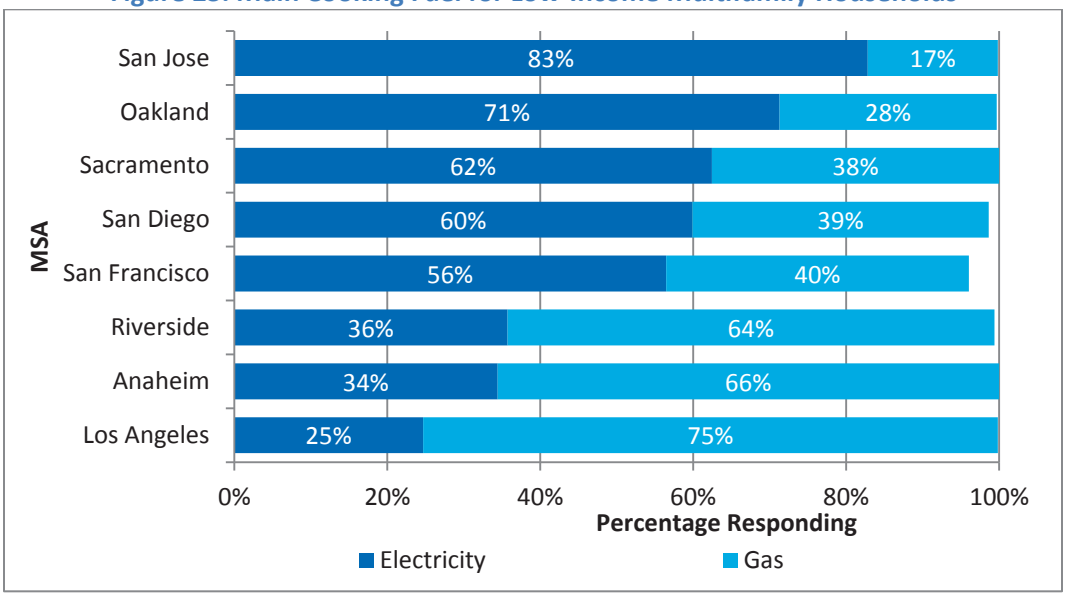
Figure 22. Main Cooking Fuel by Household Type



Source: U.S. Census Bureau American Housing Survey 2011

Figure 23 shows the main cooking fuel for low-income multifamily households, organized by MSA.

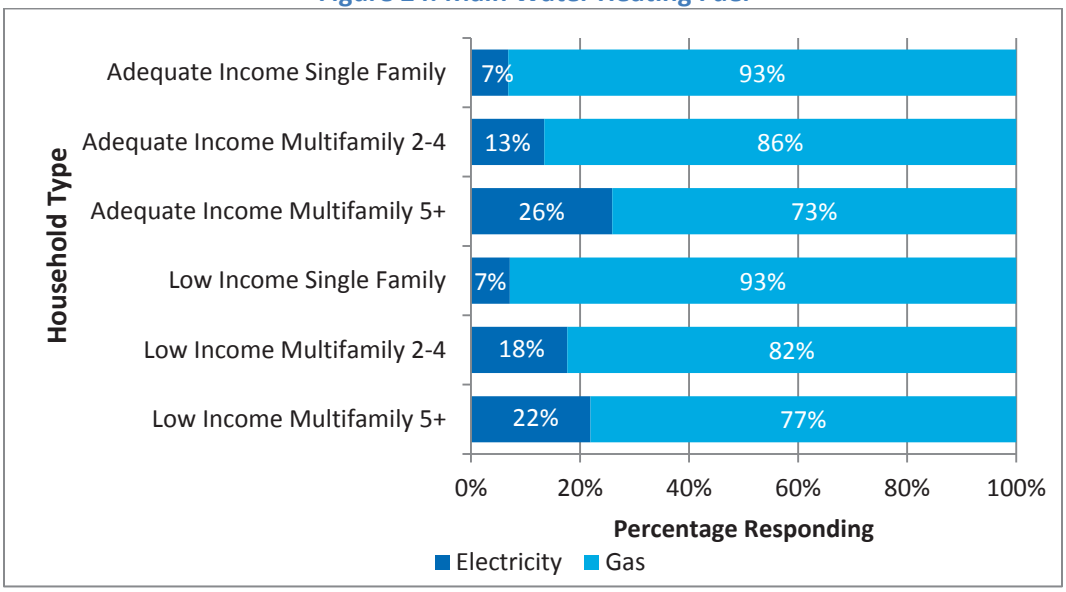
Figure 23. Main Cooking Fuel for Low-Income Multifamily Households



Source: U.S. Census Bureau American Housing Survey 2011

Figure 24 provides a comparison of the main water heating fuel, organized by household type.

Figure 24. Main Water Heating Fuel

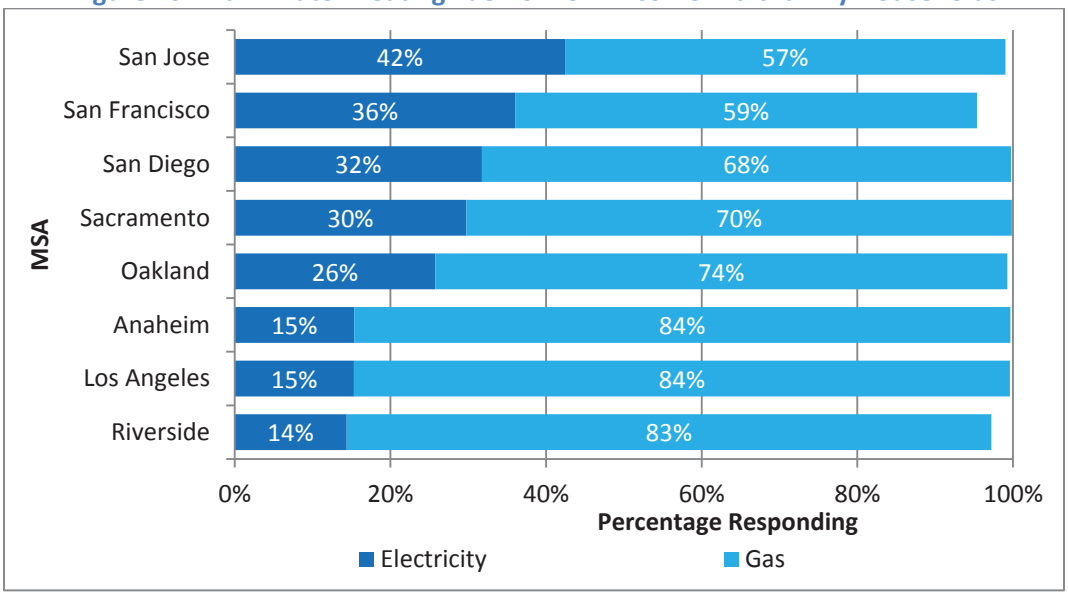


Source: U.S. Census Bureau American Housing Survey 2011

The survey does not indicate whether the water heating system among multifamily residences is a centralized or an in-unit system. All households within multifamily buildings are more likely to heat water with electricity than are single-family households. The AHS data do not provide data on whether water heating systems are for single or multiple units. The 2009 RECS data for the western census region

indicate that 50% of low-income multifamily households share water heating equipment with other "apartments, condos, households, businesses, or farm buildings." The main water heating fuels for low-income multifamily households, organized by MSA, are shown in Figure 25. Again, between the various areas, there is a large difference in the proportion of households that heat with electricity (the highest is San Jose and the lowest is Riverside).

Figure 25. Main Water Heating Fuel for Low-Income Multifamily Households

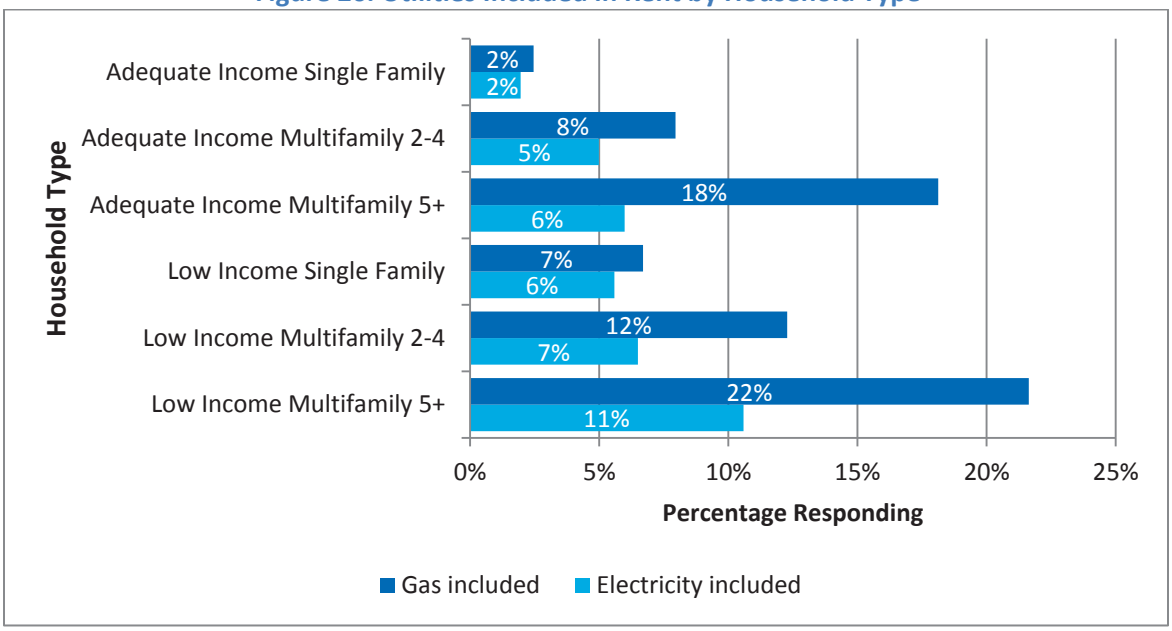


Source: U.S. Census Bureau American Housing Survey 2011

Utilities

Figure 26 shows the percentage of units, organized by household type, for which the utility costs are included in the rent. Although still a small percentage of the total, the low-income multifamily household is the most likely to have utility costs included.

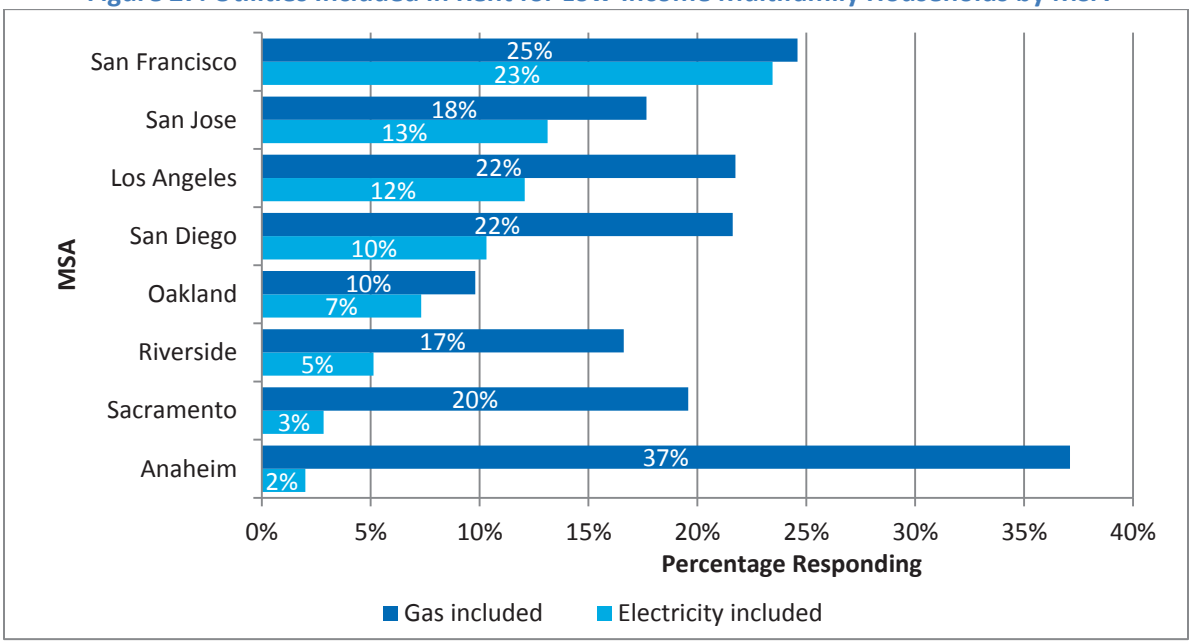
Figure 26. Utilities Included in Rent by Household Type



Source: U.S. Census Bureau American Housing Survey 2011

Figure 27 shows the percentage of units for which utility costs are included in the rent. Again, there are very significant differences from the highest to the lowest percentage MSA. For instance, roughly a quarter of low-income multifamily households in San Francisco have either gas or electricity or both included in their rent.

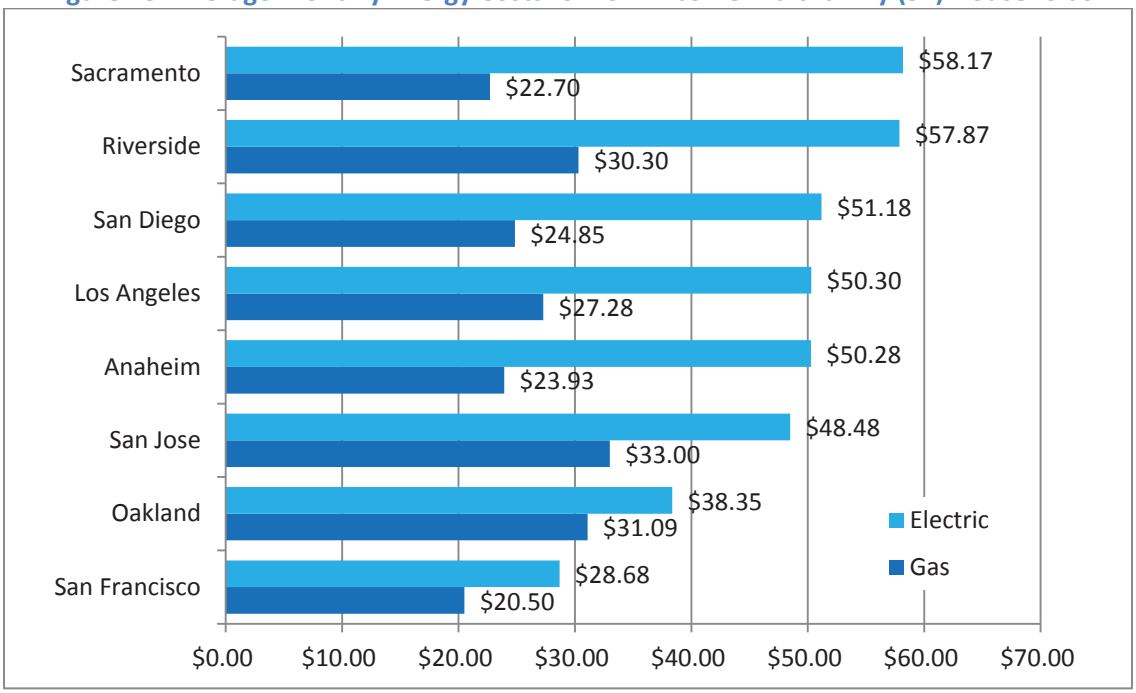
Figure 27. Utilities Included in Rent for Low-Income Multifamily Households by MSA



Source: U.S. Census Bureau American Housing Survey 2011

Figure 28 shows the 2011 average monthly energy cost of utilities for low- and adequate-income multifamily households, where the cost of utilities are not included in the rent. Utility costs are respondent reported values.[35] Note that these reported energy costs would reflect the CARE rate for respondents who receive that rate. The data do not indicate whether or not a respondent is on the CARE rate.

Figure 28. Average Monthly Energy Costs for Low-Income Multifamily (5+) Households



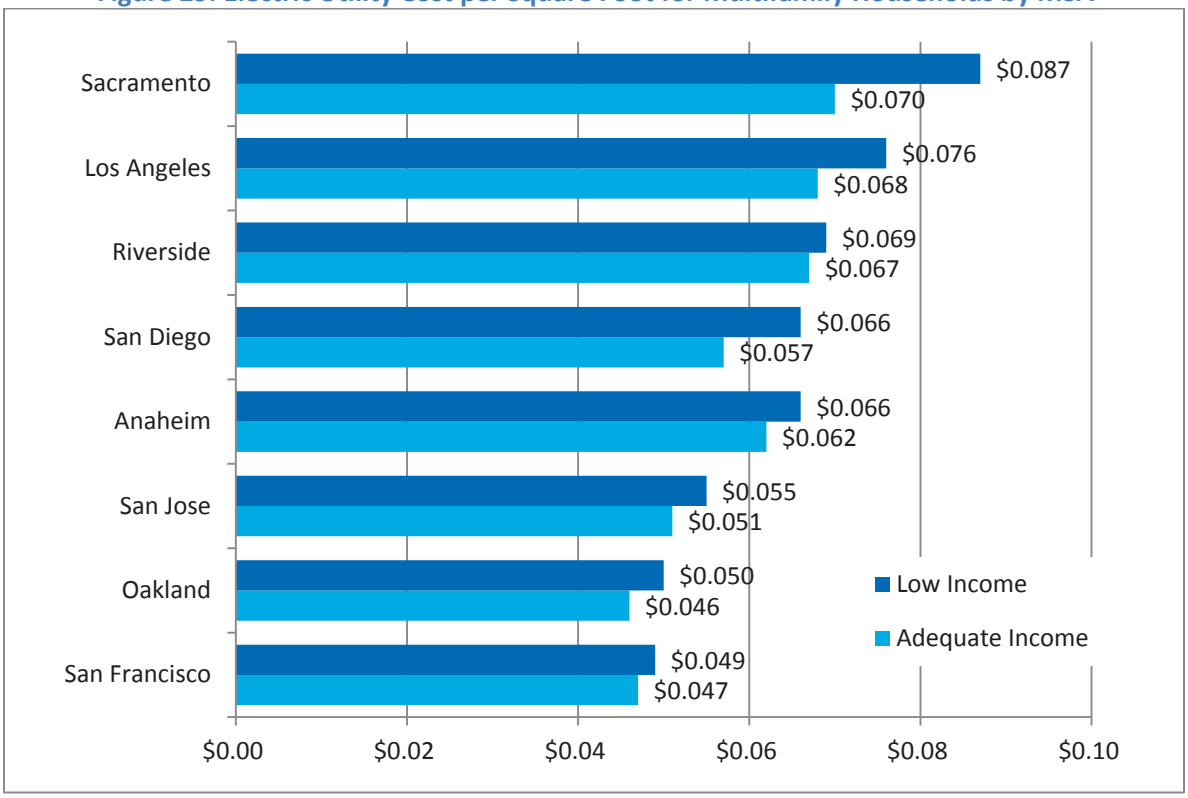
Source: U.S. Census Bureau American Housing Survey 2011

Although low-income households pay a lower total cost than adequate income households across nearly all MSAs, their cost per square foot of living space is higher. For instance, in Los Angeles, low-income multifamily households pay $50.30 per month for electricity, on average compared to $58.46 for adequate income multifamily households. But low-income multifamily households pay more for electricity per square foot: $0.076 compared to $0.068.

[35] The AHS Codebook indicates, "Respondents are asked to state their average monthly costs based on the last 12 months. If the respondent does not know the exact cost, the interviewer accepts an estimate, probing as necessary to obtain the estimate." U.S. Department of Housing & Urban Development, Office of Policy Development & Research. March 2013. "Codebook for the American Housing Survey, Public Use File: 1997-2011" P. 634.

Figure 29 shows a comparison of electricity costs per square foot of living space, by income level and MSA.

Figure 29. Electric Utility Cost per Square Foot for Multifamily Households by MSA



Source: U.S. Census Bureau American Housing Survey 2011

Based on estimates from the AHS survey, electric and gas utility costs consume about 4.5% of income, on average, among low-income multifamily households.[36] This burden is not equally distributed across the low-income multifamily sector, however: those earning no more than 50% of the Federal Poverty Guidelines spend 29% of income on average while those in the upper quarter, between 150% and 200% of poverty, spend only about 3% on average. As a point of comparison, among multifamily households with adequate income, electric and gas utility costs consume about 1% of household income.

[36] These are median values. Included in this average are households that pay directly for either gas or electricity or both and that have positive household income.

ESA Program and MFEER Penetration into the Low-Income Multifamily Sector

Summary of Key Findings

The combination of census data and ESA Program participation data allows us to provide a high-level assessment of the penetration of the program relative to the number of low-income multifamily households in a particular area. In this context, "penetration" refers to the rate of impact on the target sector (that is, the number of ESA Program participants per unit of geography).

Table 15 shows the number of program participants among low-income multifamily households during the program years 2007 to 2012, grouped into two periods and the average annual participation rate over the entire period. Going back six years of program participation by low-income multifamily households, spanning both LIEE and ESA Programs, we see that PG&E had 81,555 participants. Thus, approximately 21% of the total number of low-income multifamily households participated during this six-year period. SCE had 70,836 participants in the LIEE and ESA Programs for a population we have estimated to be 335,484 in 2011, thus also reaching about 21% of all low-income multifamily households. SDG&E, with 48,381 participants, provided services to approximately 41% of total low-income multifamily households within their service territory. SCG had 80,289 participants over six years, providing services to approximately 12% of the total number of low-income multifamily households. Note that for each utility, the second half of the period saw a dramatic increase in participation.

Table 15. Rate of LIEE and ESA Program Participation Among Low-Income Multifamily Households PY 2007 to PY 2012

Utility	Estimated Low-Income Multifamily Households	Number of Participating Households PY 2007 to PY 2009 (LIEE)	Number of Participating Households PY 2010 to PY 2012 (ESA)	Average Annual Participation PY 2007 to PY 2012
PG&E	377,015	22,678	58,877	13,593
SCE	335,484	5,061	65,775	11,806
SCG	591,929	15,779	64,510	13,382
SDG&E	116,904	15,711	32,670	8,064

The goals of the ESA Program are set relative to the entire low-income population. There is no separate goal for the multifamily sector. These goals take into consideration characteristics beyond the number of qualifying low-income multifamily households. The number of eligible and willing households adjusts the totals in Table 15 excluding households that:

- Do not meet a minimal criterion for receiving measures
- Are either resistant to participation or are not able to participate because, for instance, they cannot be present during an audit
- Have been treated through LIHEAP

Additionally, the population of eligible households is assumed to grow by 1% per year.

Thus, from the program standpoint, the denominator for full participation is a subset of total households; whereas, what we present are the number of households that meet only the two basic criteria of income and building type. As noted, the utility adjustments to the population apply to the total population of low-income households, not to any subsector such as multifamily. The utilities have applied a 5% discount on the population to account for unwilling and unable households. For their 2012-2014 ESA Program Application, PG&E and SCE have projected LIHEAP participation at 90% of the rate between 2002 and 2007. SCG&E projects 100% of that rate. SCG has not projected a number for LIHEAP.

The utilities' total rate of ESA participation across both single and multifamily sectors is designed to either achieve or surpass the goal of serving all willing and eligible households. If we look at only the multifamily sector, and apply the same assumptions applied for the total program to the rate of participation in that sector, it appears the planning may not hold for that sector. The assumptions used to estimate multifamily ESA performance are:

- Rate of participation 2002-2006 was equal to the average rate between 2007 and 2009
- Rate of participation 2013-2020 will be equal to the average rate between 2010 and 2012
- The proportion of eligible and willing households in the multifamily sector is the same as in the single-family sector
- Rate of population growth in the multifamily sector is the same as in the single-family sector
- Proportion of multifamily households participating in LIHEAP equals the proportion in the population of low-income households as a whole (32%)

Under these assumptions, SCE and SDG&E would serve all low-income multifamily households by 2020 but PG&E would only serve 87%. We did not have data with which to subtract an estimate of LIHEAP participants from SCG's eligible and willing households but if we assume that 20% of low-income multifamily households are treated by LIHEAP by 2020—about the same proportion as PG&E--we can estimate that ESA would have treated 70% of low-income multifamily households by 2020.

It would seem critical to underscore the uncertainty surrounding these estimates. The utilities will be able to adjust the program going forward to address any emerging shortfall. We would especially highlight the uncertainty associated with the assumption of a constant rate of participation as the number of remaining, untreated households declines. If, for instance, the annual rate of service is assumed to fall by 5% per year starting in 2015, because for instance it becomes more difficult to identify and treat homes, SCE will not serve all eligible and willing multifamily households.

Regression Model of ESA Program Multifamily Penetration

To better understand the penetration of the ESA Program into the low-income multifamily sector, Cadmus conducted a regression analysis of census tract data. The team wanted to understand any factors affecting the rate of program penetration. If program delivery is uniform across the state, we would expect a simple—and, ideally—linear relationship between the number of eligible multifamily households and the number of participating multifamily households. Significant parameter values on additional predictor variables related to socio-demographics would indicate that these factors either increase or decrease the rate of program penetration.

We predicted ESA Program participation in each census tract based on:

- The number of low-income multifamily households
- Median income
- Number of multifamily households
- Total black or African American population
- Total Hispanic population
- Total "other" population
- Total LEP population

A complete discussion of this modeling effort is presented in Appendix E. Here, we summarize our findings.

As expected, the ESA Program has a higher rate of program penetration where there are more low-income multifamily households. The increase in ESA Program participation does not keep up with increases in low-income multifamily households, however, and high concentrations of low-income multifamily households tend to be served at a lower rate of penetration than lower concentrations. In other words, ESA Program participation goes up with a rise in the number of LIMF households, but the percentage of low-income multifamily households served tends to go down.

With respect to income, ESA Program participation goes down as the median income of a census tract goes up. In fact, a doubling of income yields about a quartering of ESA Program participants, all else being equal comparing one census tract to another. Again, this relationship is in the expected direction and shows the keen sensitivity of ESA Program penetration to income. Because the effect of income exists even controlling for the number of low-income multifamily households, it suggests that where these households exist among more-affluent households, they are less likely to participate in the program. In other words, if two census tracts had the same number of low-income multifamily households but in one tract the median income was higher, we would expect the rate of participation to be lower.

Our model found no strong evidence that racial or ethnic identity is associated with increased ESA Program participation, though for some utilities a weak relationship exists. We did identify a relationship suggesting that areas with higher numbers of limited English proficiency households have higher participation rates in the ESA Program.

Thus, our regression model does not identify any strong factors related to the uniformity of participation in the ESA program other than what is expected, the number of low-income multifamily households, with the one exception of the relative economic affluence of the area where the households are located. Where low-income multifamily households are situated among more affluent households, their rate of participation is lower.

Measures Installed in Multifamily Housing Through the ESA Program and MFEER

Summary of Key Findings

In this section, Cadmus reports on the number of measures installed in low-income multifamily households through the ESA Program, by utility and climate zone. One goal of our research was to identify missed opportunities for measure installation. Note that conducting a complete evaluation of missed opportunities would require a review of inspection data from participating households—and possibly site visits. Our approach is more aggregate and data-driven: we have counted the number of households receiving different categories of measures. We cannot say whether individual households received too much or too little of each measure; but, we can say that the list of measures includes a substantial menu across five measure categories. The list of candidate measures was extensive and included 106 distinct measures for PG&E and 116 distinct measures for SCG. SCE and SDG&E presented data in more aggregate form, rolled into measure categories. A list of ESA measures is presented in Appendix H.

Methodology

To analyze the mix of measure across utilities and climate zones, Cadmus created a consolidated list of distinct measure names from each utility's participation data. We then mapped the names to these five categories that encompass all energy-saving measures:

- Appliances
- Envelope and air sealing
- Domestic hot water
- HVAC
- Lighting

All participants received an assessment and energy education.

We joined the measure category names to the measure-level participation data and then we linked them to the previously geocoded[37] participant records, thus, associating the participants with their climate zones.[38]

[37] Geocoding converts a street addresses to latitude and longitude coordinate points. Two separate geocoders were used. The first pass used the ESRI StreetMap North America road data. A second pass used the ArcGIS

ESA Program Measures for Multifamily Housing

For the years from 2009 through 2011, Table 16 shows the number of ESA Program participants living in multifamily housing and the percentage of participants receiving measures within five measure categories.

- ***Appliances:*** Of SCE MF participants, 18% received appliances (specifically, refrigerators). PG&E distributed microwave ovens to 1% of multifamily participants and refrigerators to 13% of multifamily participants.[39] At SDG&E, for example, 3% of participants received microwaves and 6% received refrigerators.
- ***Envelope and Air Sealing:*** At PG&E and SDG&E, more than 70% of multifamily participants received measures in the categories of envelope and air sealing and domestic hot water. Among SCG ESA multifamily 5+ participants, more than 90% received envelope and air sealing measures.
- ***Domestic Hot Water:*** Three-quarters or more of participating multifamily households received domestic hot water measures except among SCE's participants where, the prevalence of gas water heat makes the measure a less important source of electric savings.
- ***Heating and Cooling:*** These measures are reported in greater detail in Table 17. For all utilities, only a minority of multifamily households received HVAC measures, with about 11% of SDG&E households receiving heating measures and 14% of PG&E households receiving cooling measures.
- ***Lighting:*** Most participating multifamily households in PG&E's and SDG&E's programs received lighting measures. SCG did not distribute lighting measures because it is a gas only utility.

Table 16. Percentage of Participating Multifamily Households Receiving ESA Program Measures[1, 2]

Utility	Participants	Appliance	Envelope & Air Sealing	Domestic Hot Water	Heating	Cooling	Lighting
PG&E	58,877	14%	82%	84%	1%	14%	89%
SCE	65,775	18%	2%	0%	1%	1%	36%
SCG	64,510	0.1%	92%	98%	3%	0%	0%
SDG&E	32,670	14%	75%	73%	11%	2%	96%

1. Data is for PY2010 through PY2012.
2. Percentages are of total MF households receiving measures during 2010 through 2012.

Online geocoder for addresses that were geocoded to a ZCTA centroid or could not be geocoded during the first pass.

38 In the case of PG&E, because the measure-level data were provided separately, these were joined to the original participants, by address. Of the 59,259 original participant records, 125 could not be linked to the measure-level data.

39 For PG&E, microwave ovens were offered through a limited pilot in in 2009-2010, and were not offered in 2011. Microwaves are back in the program starting 2013 as a regular PG&E ESA program measure.

At PG&E and SDG&E, significant numbers of multifamily participants received HVAC measures. As shown in Table 17, the majority of HVAC measures installed through PG&E's ESA Program were cooling measures. At SDG&E, about 11% of participants received heating equipment repair or replacement.

Table 17. Percentage of ESA Multifamily Program Participants Receiving HVAC Measures

Utility	HVAC Detail	Percentage Receiving Measures
PG&E	Central AC repair/replacement	9.65%
PG&E	Furnace repair/replacement	0.04%
PG&E	Room AC	2.46%
SCE	Central AC repair/replacement	0.74%
SCE	Evaporative cooler	0.02%
SCE	Heat pump	0.10%
SCE	Room AC	0.19%
SCE	Thermostat	0.43%
SCG	FAU Stand Pilot / Change Out	0.21%
SCG	Furnace Clean & Tune	0.80%
SCG	Furnace Repair / Replace	0.12%
SDG&E	FAU Stand Pilot / Change Out	0.25%
SDG&E	Furnace Clean & Tune	8.58%
SDG&E	Furnace Repair / Replace	10.55%
SDG&E	Central A/C Tune-up	0.003%
SDG&E	Room A/C Replacement	2.03%

1. Data is for PY2010 through PY2012.
2. Percentages are of total MF households receiving measures during 2010 through 2012.

In a review of HVAC measures by weather zone, we noted the following ways in which the utilities concentrated their resources for HVAC improvement. Although only a small percentage of SCE participants received HVAC equipment overall, sizeable percentages received cooling measures in climate zones 14 (8% of households) and 15 (36% of households). These are desert areas, most of which experience well over 2,000 cooling degree days, some areas experiencing as much as 6,500 cooling degree days. Similarly, PG&E's efforts were focused on cooling measures in climate zones 11, 12, 13, and 16, which are the only PG&E CZs for which AC is authorized, where between 10% and 29% of households received central AC tune-ups. SDG&E's HVAC measures were primarily related to furnace repair and tune-up and were spread relatively evenly across the two primary climate zones within its utility territory. Among SCG multifamily participants, HVAC measures were received by only a small minority of households in any weather zone.

ESA Program Measure Costs

Table 18 shows the number of multifamily households for each utility participating in the ESA program during program year 2012, as well as the total costs for energy saving measures and the cost per participating household.[40] These data were provided by the utilities as special, multifamily 5+ extractions of cost.

Table 18. ESA Program PY 2012 Participating Multifamily 5+ Households and Measure Costs

Utility	Multifamily Households	Measure Cost	Cost per Household
PG&E	19,723	$8,283,942	$420
SCE	13,839	$2,158,019	$156
SCG	17,897	$3,925,482	$219
SDG&E	10,009	$2,878,598	$288

Table 19 shows the cost per unit that utilities spent to install measures through the ESA program. These costs were arrived at by dividing the total measure cost by the number of treated units. Thus, significant variation from project to project may be concealed within the average. One line in particular to draw attention to is the average cost for furnaces which includes replacement of both central systems and wall furnaces, as well as the repair of furnaces. Costs for replacing a central furnace system vary greatly by installation. The cost for central AC and heat pump replacement derives from a bottom-up calculation of costs provided by SCE and includes the cost of duct sealing and testing as part of the installation.

Table 19. Summary of ESA Program Unit Measure Costs by Utility

Measure	PG&E	SCE	SCG	SDG&E
Heating Systems				
Furnaces	$1,621			$1,037
Forced Air Unit Standing Pilot Change Out			$284	$329
Furnace Clean and Tune				
Cooling Measures				
A/C Replacement - Room	$1,017	$720	$993	
A/C Replacement - Central		$4,000		
A/C Tune-up - Central	$216			
Heat Pump		$4,000		
Infiltration & Space Conditioning				
Envelope and Air Sealing Measures	$202	$104	$133	$177
Duct Sealing		$194		$359
Attic Insulation	$749		$786	$770

[40] These include the installed cost of measures but not costs for outreach and assessment or in-home education. They also do not include administration costs.

Measure	PG&E	SCE	SCG	SDG&E
Water Heating Measures				
Water Heater Conservation Measures	$48	$83	$70	$46
Water Heater Replacement - Gas	$1,243		$892	$1,035
Thermostatic Shower Valve	$20		$7	
Lighting Measures				
CFLs	$5	$6	$7	
Interior Hard wired CFL fixtures	$72		$79	
Exterior Hard wired CFL fixtures	$71			
Torchiere		$50	$101	
LED Night Lights			$3	
Appliances				
Refrigerators -Primary	$717	$790	$574	
Microwave	$80		$90	
Thermostatic Shower Valve	$20		$62	
LED Night Lights			$3	
Occupancy Sensor	$52			
High Efficiency Clothes Washer			$629	$750

Measures Installed Through the MFEER Program

Based on matching street addresses, about 6% of MFEER street addresses match ESA Program addresses. MFEER may benefit low-income households that are not ESA Program participants; however, from the data we have reviewed, it is difficult to discern the portion of benefit accruing to tenants. Also, given the differences in the program design and target markets (e.g., for MFEER the building is targeted and the contractors are given incentives for specific measure installations whereas for the ESA Program, the low-income customer is targeted, and the unit is treated for "all" feasible measures). In addition, the programs are driven by different overall goals; for example, the MFEER program pursues kWh goals, whereas the ESA Program pursues a "homes treated" goal. Not, surprisingly, such programmatic goals will drive marketing and outreach strategies for the two programs.

Across all MFEER participating properties, the measures installed tended to be homogeneous for a given utility.

- ***PG&E:*** PG&E had the most diverse distribution of measure installations: 69% were for lighting, 16% were appliances, and 10% were hot water.
- ***SCE:*** In SCE's territory, 98% of measures installed through MFEER were lighting, and approximately 45% of these were interior CFL fixtures. The remaining measures were either exterior CFL fixtures or T-8 fixtures, and we would expect savings benefits from these measures to go to property owners. At the same time, in some cases, the tenants may benefit from non-savings benefits such as safety if common areas are well-lit.

- ***SCG:*** At SCG, 95% of MFEER measures were shell measures, which would benefit tenants insofar as they pay for the cost of heating and cooling their units. Similarly, tenants may benefit from comfort related benefits resulting from the MFEER program.
- ***SDG&E:*** At SDG&E, 72% of measures were lighting and 25% were water heating. Again, the property owners and tenants may receive slightly different benefits from the MFEER program with the property owners more likely to benefit from the kWh savings associated with MFEER.

The Number of Buildings Housing Low-Income Multifamily Households

Our data do not provide clear evidence of the number of buildings within which low-income multifamily households reside. Census data is organized around individuals and households, not buildings. Results provide information about the number of units in the buildings within which respondents reside but no information about the percentage of units in each building that are inhabited by low-income households. We can provide a rough estimate of the number of buildings that house low-income households if we assume an average proportion of households within each building that qualify as low-income.

From the three-year ACS data, we know that the distribution of households by building size is:

- 27% of households in buildings of 5 to 9 units
- 24% of households in buildings of 15 to 19 units
- 22% of households in buildings of 20 to 49 units
- 27% of households in buildings of 50 or more units

If we assume the midpoint of each size category is the average building size, we can divide the number of households living in each category by the midpoint to estimate the number of buildings.[41] For instance, of the 377,015 low-income multifamily households living in PG&E's territory, about 27% live in buildings with an average of 7 units (i.e. midpoint of the "5 to 9 units" category). If all low-income families lived only with other low-income families, the following equation would provide an estimate of the total number of buildings.

$$\frac{(\text{Low} - \text{Income Multifamily Population} \times \text{Percent in Size Category})}{\text{Midpoint of Size Category}}$$

In the above example, we would estimate (377,015* 0.27) / 7 = 14,542 buildings.

Since we cannot assume that low-income multifamily households live in buildings exclusively with other low-income households, that is, since low-income multifamily households live in buildings mixed among adequate income households, the number of buildings housing *any* low-income multifamily households

[41] For the uppermost category, we have estimated a midpoint of 74 units. This is based on a regression analysis conducted for the MFEER program evaluation.

must be larger than the equation above would imply. If we knew the average mixing ratio of low-income and adequate income households in multifamily buildings we could inflate to population accordingly. The adjusted equation for each size category is:

$$\frac{(\text{LIMF Population} \div \text{Average Percent LI in Building} \times \text{Percent in Size Category})}{\text{Midpoint of Size Category}}$$

We do not have a good source of data on this ratio, however.

Table 20 shows an estimate of the number of buildings that house low-income multifamily households assuming a mixing ratio of 2:1 for market rate buildings and a ratio of 3:1 for rent-assisted buildings. This means, for instance, that on average in market rate buildings where low-income multifamily households reside, two-thirds of all households in the building are low-income. In buildings where tenants receive assistance, three-fourths of all households receive assistance. This estimate suggests there are approximately 33,889 buildings housing low-income multifamily households in PG&E's territory, 30,128 in SCE's territory, 10,546 in SDG&E's territory, and 52,812 in SCG's territory. The lower the mixing ratio, the more spread out are low-income multifamily households across the multifamily buildings and thus the larger the number of buildings housing them. Thus, if the mixing ratio for market rate buildings is 1:1 rather than 1:2, there are 36,793 buildings in PG&E's territory or 9% more.

In this table we also estimate the number of market rate and rent-assisted buildings. To arrive at this value we applied the proportion of those two groups in MSAs served by each utility, broken out by building size, to the number of buildings in each size category for each utility. For instance, in the Riverside and Anaheim MSAs, 26% of households in buildings with five to nine units receive government rent assistance. Thus, we apportioned 26% of buildings in this size category for this utility into the rent assistance sector.

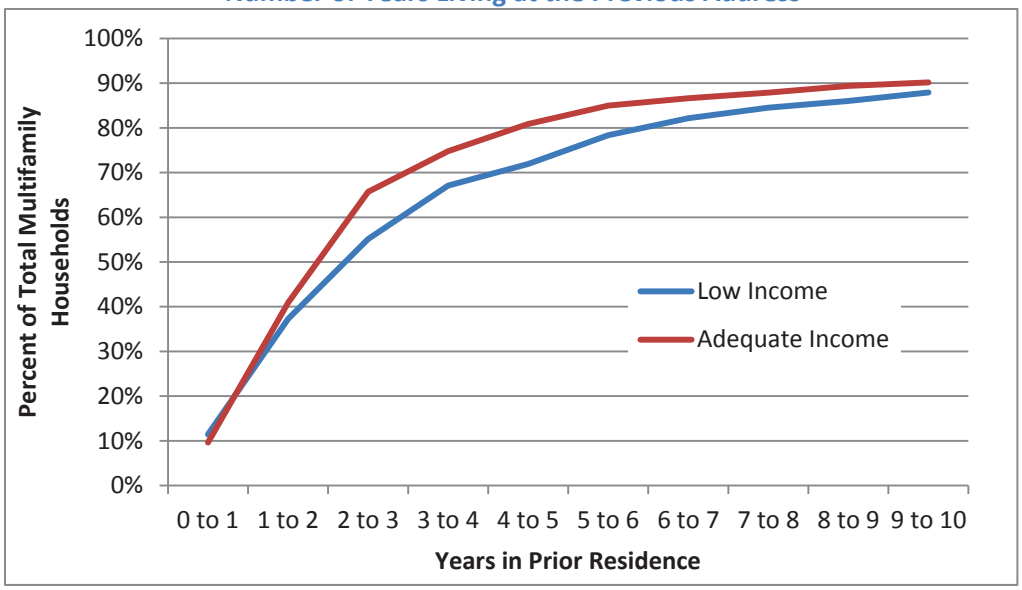
Table 20. Estimate of the Number of Low-Income Multifamily Buildings by Utility

Utility	Building Size	Percentage of Multifamily Households	Low-Income Multifamily Households	Low-Income Multifamily Households and Neighbors	Buildings Housing Low-Income Multifamily Households	Low-Income Multifamily Rent-assisted Buildings	Low-Income Multifamily Market Rate Buildings
PG&E	5 to 9 Units	27%	103,566	142,204	20,315	4,845	15,470
	10 to 19 Units	24%	88,787	120,632	8,319	1,265	7,055
	20 to 49 Units	22%	82,529	113,789	3,298	899	2,399
	50 or More Units	27%	102,134	144,766	1,956	987	969
	Total	**100%**	**377,015**		**33,889**	**7,996**	**25,893**
SCE	5 to 9 Units	27%	92,157	126,793	18,113	4,619	13,494
	10 to 19 Units	24%	79,006	107,644	7,424	1,298	6,125
	20 to 49 Units	22%	73,437	100,582	2,915	635	2,280
	50 or More Units	27%	90,883	124,017	1,676	314	1,362
	Total	**100%**	**335,484**		**30,128**	**6,866**	**23,262**
SDG&E	5 to 9 Units	27%	32,114	44,320	6,331	1,776	4,555
	10 to 19 Units	24%	27,531	37,662	2,597	540	2,057
	20 to 49 Units	22%	25,590	35,115	1,018	238	780
	50 or More Units	27%	31,669	44,342	599	240	359
	Total	**100%**	**116,904**		**10,546**	**2,794**	**7,752**
SCG	5 to 9 Units	27%	162,603	221,997	31,714	6,076	25,637
	10 to 19 Units	24%	139,399	188,797	13,021	1,643	11,377
	20 to 49 Units	22%	129,573	176,191	5,107	810	4,297
	50 or More Units	27%	160,354	219,797	2,970	666	2,304
	Total	**100%**	**591,929**		**52,812**	**9,196**	**43,616**

Housing Unit Mobility Among Low-Income Multifamily Households

The AHS provides information about the rate at which households move from one housing unit to another. The survey collects information about the year the respondent moved into the current housing unit, and importantly, about the year the respondent had moved into the previous housing unit. The difference in years, plus one, is the maximum time a survey respondent could have spent living in the previous housing unit.[42] Figure 30 shows the cumulative distribution of households by the number of years living at the previous address. To help control for faulty memories, we limited our analysis to households that had moved into the current residence within the past five years. Both low-income and adequate income sectors are represented. We note that low-income households remained in their previous unit slightly longer, on average. Nevertheless, within seven years, 82% of low-income multifamily households had moved from their prior residence into the current one.

Figure 30. Cumulative Distribution of Multifamily (5+) Households by the Number of Years Living at the Previous Address



Source: American Housing Survey

[42] For instance, if a respondent moved into the current unit in 2011 and into the previous unit in 2009, the difference in years is two; but, it is possible the respondent moved into the unit in January 2009 and moved out in December 2011. So, 3 years is the maximum time the respondent could have lived in the unit. For our purposes, this estimate will be precise enough. This analysis represents a simplification of housing unit mobility because households do not all remain intact as they move from one unit to another.

Section 4. Surveys and Interviews

Surveys with Owners and Operators of Low-Income Multifamily Buildings

Summary of Key Findings

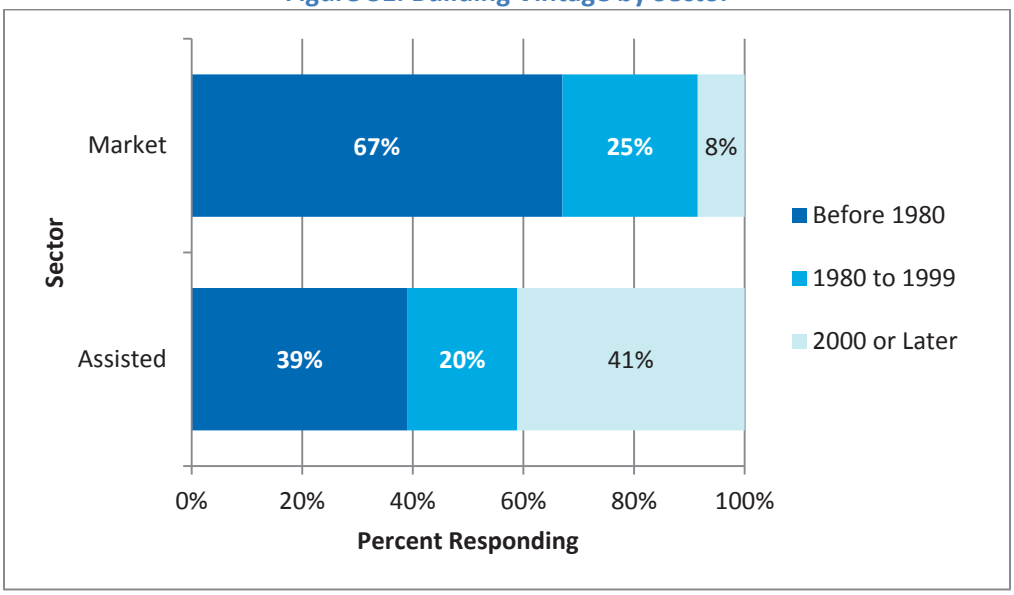
Using data collected from the telephone survey with owners and operators of multifamily buildings with low-income tenants, we collected information about the building characteristics including equipment in apartment units and common areas, awareness of IOU energy efficiency programs, and decision-making related to purchase and installation of energy efficient equipment. By extension, these data provided information about the tenants' needs. The surveyor asked respondents about their perception of energy efficiency upgrades needed at their property, but the survey was not intended to take the place of a comprehensive building audit.

Appendix F provides details about this survey's research methodology and sampling plan. The appendix provides a description of the data sources for the stratified sample and the convenience sample, and presents the sample attrition tables. The appendix also discusses the challenges conducting this survey.

Building Characteristics

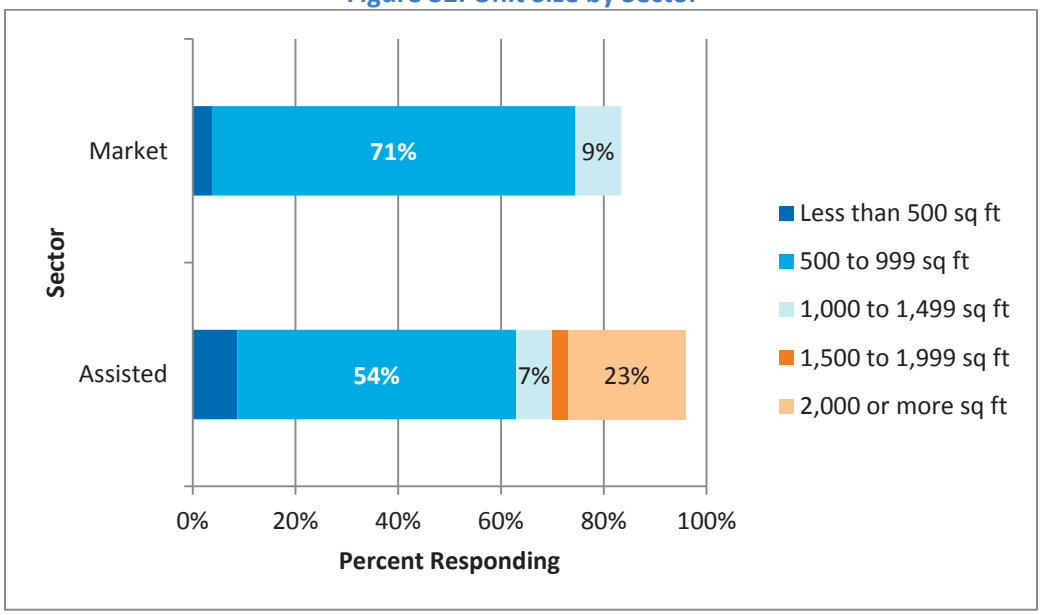
Although the AHS data (discussed in Section 3 of this report) provide a generally richer set of data for characterizing low-income multifamily buildings, especially because of the relatively large sample of assisted properties, there are some important points of information to glean from survey data. As shown in Figure 31, survey data suggest that buildings in the assisted sector are of more recent vintage, on average than market rate buildings. Fully two-thirds of the market rate respondents said their building was built before 1980, whereas only 39% of buildings in the assisted sector sample were built before 1980.

Figure 31. Building Vintage by Sector



The survey findings also indicate that the average size of apartment units in the assisted sector is larger than in the market rate sector. As indicated in Figure 32, fully 23% of respondents from the assisted sector said the average size of their units is 2,000 square feet or more; however, no one from the market rate sector reported average unit size as large as 2,000 square feet.

Figure 32. Unit Size by Sector



As seen in Table 21, this is related to the number of bedrooms in the apartments discussed in the survey. The survey findings show that size of apartment correlates with number of bedrooms. Half of studio apartments are less than 500 square feet, 17% of studio apartments are between 500 and 1,000

square feet, and one-third said they did not know the size of studio apartments. All one-bedroom apartments are less than 1,000 square feet. All two-bedroom apartments are 500 square feet or more with 76% between 500 and 1,000 square feet. Three bedroom apartments range in size from 500 square feet to more than 2,000 square feet (43%).

Table 21. Number of Bedrooms and Size of Apartments*

	Less Than 500	500 to Less Than 1,000	1,000 to Less Than 1,500	1,500 to Less Than 2,000	2,000 or More	Don't Know	Refused
Mostly Studios (n=6)	50%	17%	0%	0%	0%	33%	0%
Mostly 1 Bedroom (n=13)	23%	77%	0%	0%	0%	0%	0%
Mostly 2 Bedrooms (n=95)	0%	76%	11%	0%	0%	13%	1%
Mostly 3 Bedrooms (n=7)	0%	29%	29%	0%	43%	0%	0%

* Size is in square feet.

Rent and Utilities

Nearly all, 94% of respondents, reported that apartment units are individually metered for utilities. Only 12% of respondents said all utilities are included in the rent; 18% said none; and 70% said some. Water, sewer, and garbage are the most common utilities included in rent. Respondents reported electricity is included in the rent, 28%, and including gas in the rent was reported by 26% of respondents.

Respondents estimated the typical monthly rent for units at their property. Rents ranged from less than $250 to over $1,500. Average rent depends on apartment size but the most common monthly rents are $500 to $750 (45%).

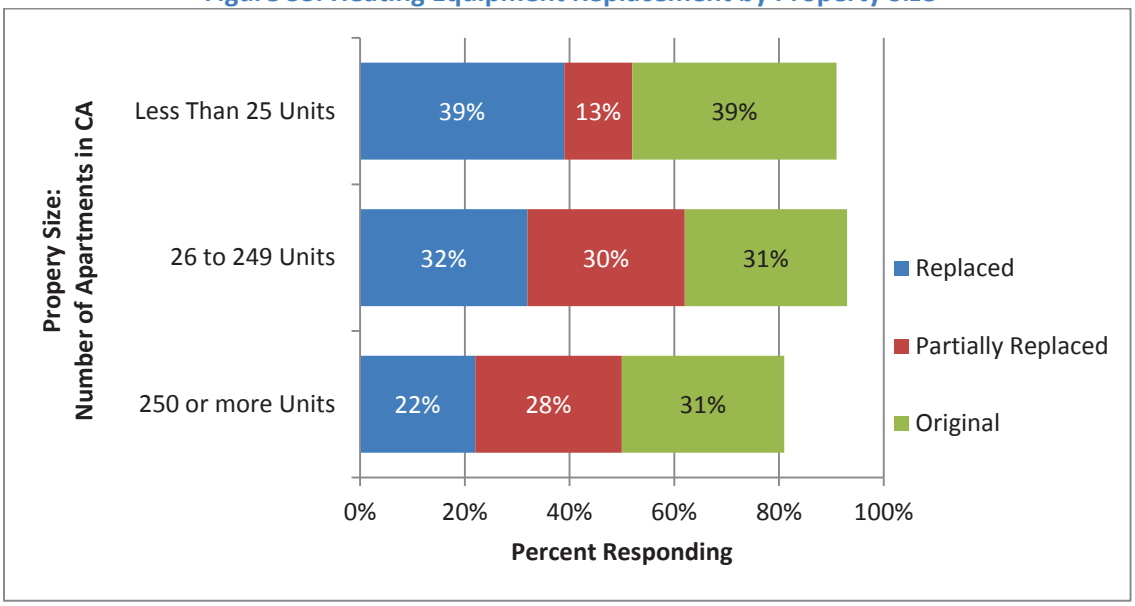
Table 22. Rent by Size of Apartment

Rent	Less than 500 sq ft	500 to 999 sq ft	1,000 to 1,499 sq ft	1,500 to 1,999 sq ft	2,000 sq ft or more	Don't Know
$250 or less	10%	-	-	-	-	-
$251 to under $500	1%	2%	-	-	99%	12%
$500 to $750	88%	48%	53%	-	-	27%
$751 to under $1,000	1%	15%	11%	-	1%	20%
$1,000 to under $1,200	-	8%	16%	-	-	9%
$1,200 to under $1,500	-	9%	16%	100%	-	-
$1,500 or more	-	4%	4%	-	-	-
30% of income	-	3%	-	-	-	-
Depends on income	-	3%	-	-	-	-
Don't know	1%	4%	-	-	-	33%
Refused	-	4%	-	-	-	-

Equipment Replacement

While the AHS data (see Section 3) provide precise information about the type of heating and cooling equipment installed in multifamily buildings housing low-income tenants, they do not indicate whether the equipment has been replaced. A surveyor asked respondents whether the heating equipment in their building (discussed in the survey) was replaced or was original to the building. Figure 33 shows responses for the building discussed in the survey, sorted by the respondents' property size. Property size is defined by the number of apartment units owned or managed by respondents in California. A large percentage of respondents were unable to answer the question. The responses do not vary greatly by property size, except that owners of small properties are less likely to partially replace equipment.

Figure 33. Heating Equipment Replacement by Property Size



The survey also asked about cooling equipment. Results are quite consistent with findings of the much larger AHS dataset, with 36% of respondents saying their building has central AC, 23% saying their building's units have room AC, and 34% saying the units have no AC. Replacement of original AC equipment is closely related to building vintage. Almost half, 47% of respondents managing buildings built in 2000 or later, saying central AC equipment is original and only 8% of respondents managing buildings built before 1980 saying the AC equipment is original.

Common Areas

The survey provides information about common areas in low-income multifamily buildings that is unavailable from the AHS dataset. The majority of buildings discussed in the survey have common areas, regardless of size; however, larger buildings are more likely to have a common area. Among respondents managing buildings with 25 or fewer units on the property discussed in the survey, 77% said the building had a common area. Among respondents managing larger buildings the percentages were larger: 93% for buildings with 26 to 249 units and 100% for buildings with 250 units or more on the property. Respondents managing buildings built after 2000, however, were more likely to say their

building did not have a common area than respondents managing buildings of an older vintage (39% compared to 11%).

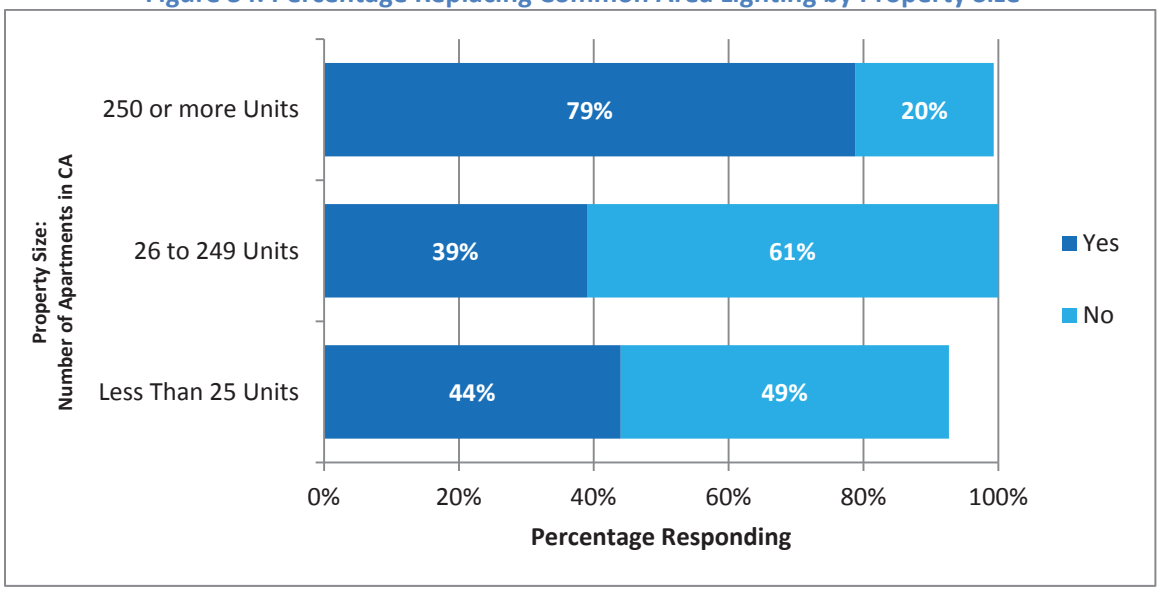
Among respondents with common areas in the building discussed in the survey, 48% said the common areas are not heated; 54% said the common areas are not cooled.

Gas is the dominant fuel used to heat common areas. Respondents reported system types included furnaces, boilers, rooftop units and baseboard or wall heaters. Electricity is the dominant fuel used to cool common areas. Central AC units are most often used to cool common areas; some swamp coolers and window AC units are used.

Lighting and Equipment Upgrades

Another area where the AHS dataset offers relatively little insight is in providing specific information about property upgrades. The survey asked a series of questions about equipment replacement *"in the past couple of years"* for common area lighting and lighting in units, heating and AC equipment, clothes washers in common areas, and appliances in units. Respondents managing larger buildings were more likely to say they had replaced equipment. For instance, Figure 34 shows the number of respondents who said they had replaced common area lighting, by property size.

Figure 34. Percentage Replacing Common Area Lighting by Property Size

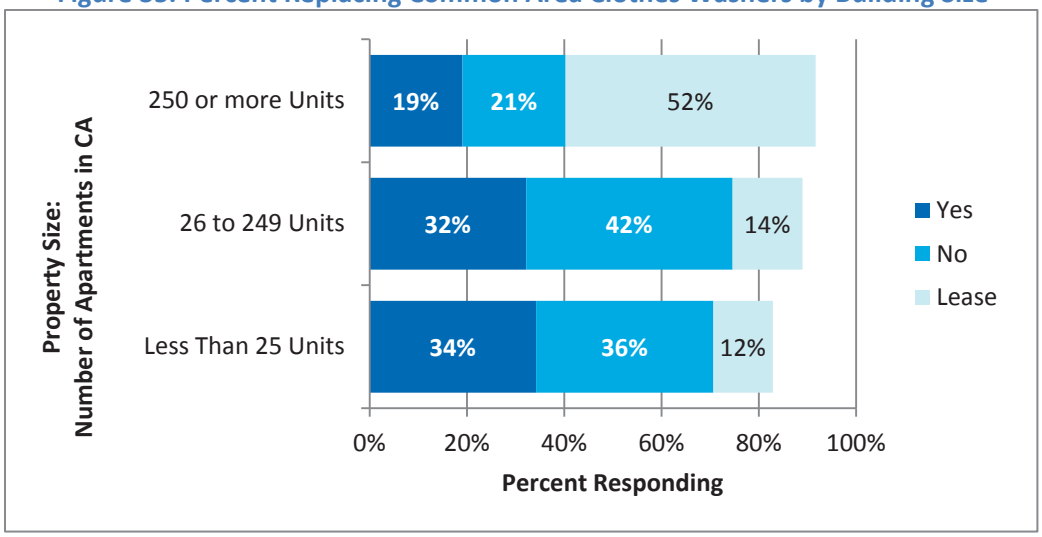


Exactly 50% of respondents said they replaced equipment for the purposes of upgrading it, without the equipment being broken. There is no indication, however, that managers of large properties were more likely to install *high efficiency* equipment. To the contrary, 50% of small property managers (having 25 or fewer units) said they had installed high efficiency lighting in common areas, as compared to about 35% of larger building managers.

Within tenant units, the percentage of respondents saying they had replaced lighting equipment in the past couple of years was nearly identical to the percentage saying they had replaced outdoor and common area lighting. Specifically, 80% of those managing 250 units or more in California, 42% of those managing between 25 and 249 apartment units, and 45% of those managing fewer than 25 apartment units had replaced lighting in the apartments. Fifty-five percent of respondents said they had replaced equipment to upgrade it; 54% said they had replaced lighting with high-efficiency equipment. Once again, however, data show that managers of the larger numbers of apartment units—above 25 units--were less likely to have replaced lighting equipment with high-efficiency units than were managers of 25 units and smaller: 47%, as compared with 65%.

For clothes washers located in common areas, the managers of the largest numbers of units report they are most likely to lease equipment, rather than purchase it. That practice is less common for managers of smaller numbers of units, as shown in Figure 35.

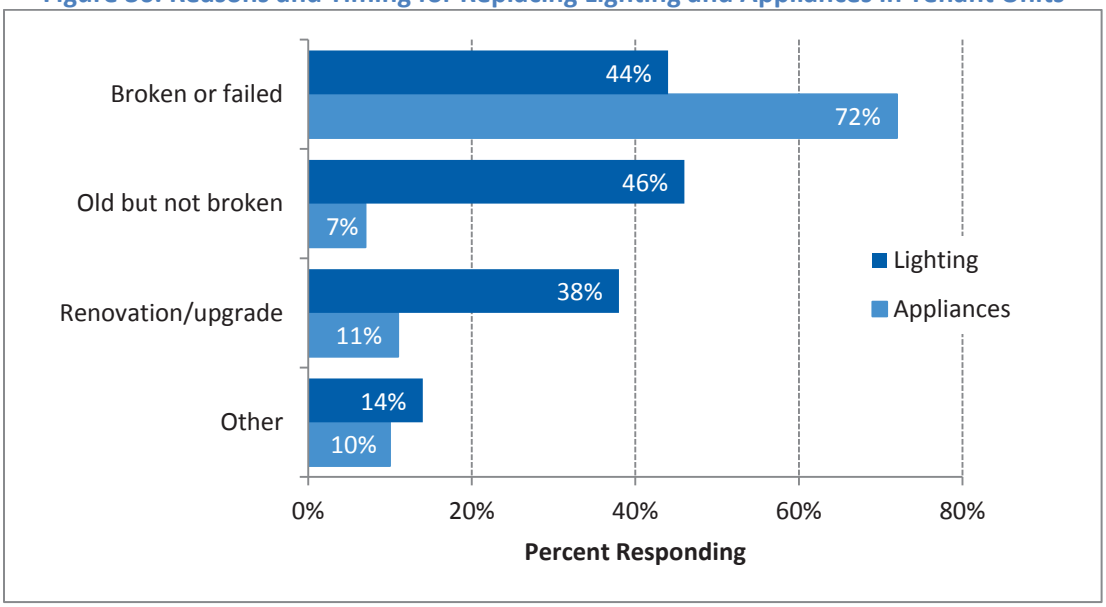
Figure 35. Percent Replacing Common Area Clothes Washers by Building Size



About one-third of respondents said they had installed high efficiency equipment, with no significant difference by size.

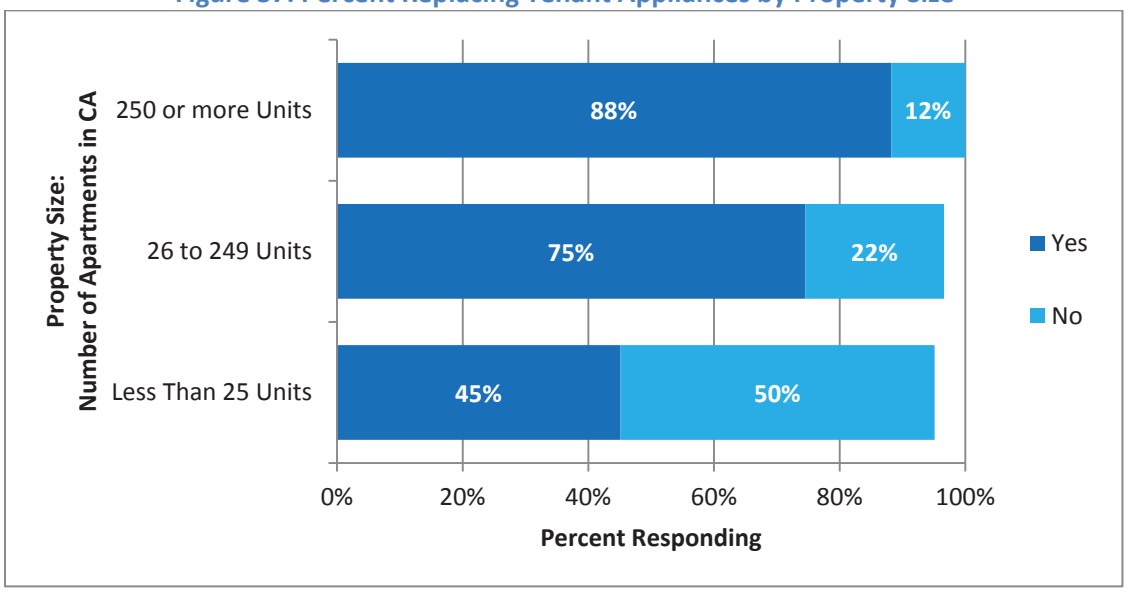
Lighting upgrades in tenant apartments occur for different reasons than appliance upgrades. Lighting is upgraded 44% of the time because it is broken or failed, and 46% of the time when it is old but not broken. Lighting is replaced 38% of the time as part of a renovation or upgrade. About 54% said lighting was replaced with high efficiency equipment. Appliances are most often replaced (72%) when it breaks or fails (Figure 36).

Figure 36. Reasons and Timing for Replacing Lighting and Appliances in Tenant Units



In the tenant apartments at the property discussed in the survey, the percentage of respondents who said the appliances were replaced within the past couple of years is shown in Figure 37. Seventy-two percent of respondents said appliances were replaced because they were broken or had failed. Only 11% said the appliance replacements were part of an upgrade. Overall, 35% said that equipment was replaced with high-efficiency equipment. This was higher (48%) in large properties (250 or more units on the property discussed in the survey) than in small properties. Also, 19% of respondents did not know the efficiency of the installed equipment.

Figure 37. Percent Replacing Tenant Appliances by Property Size

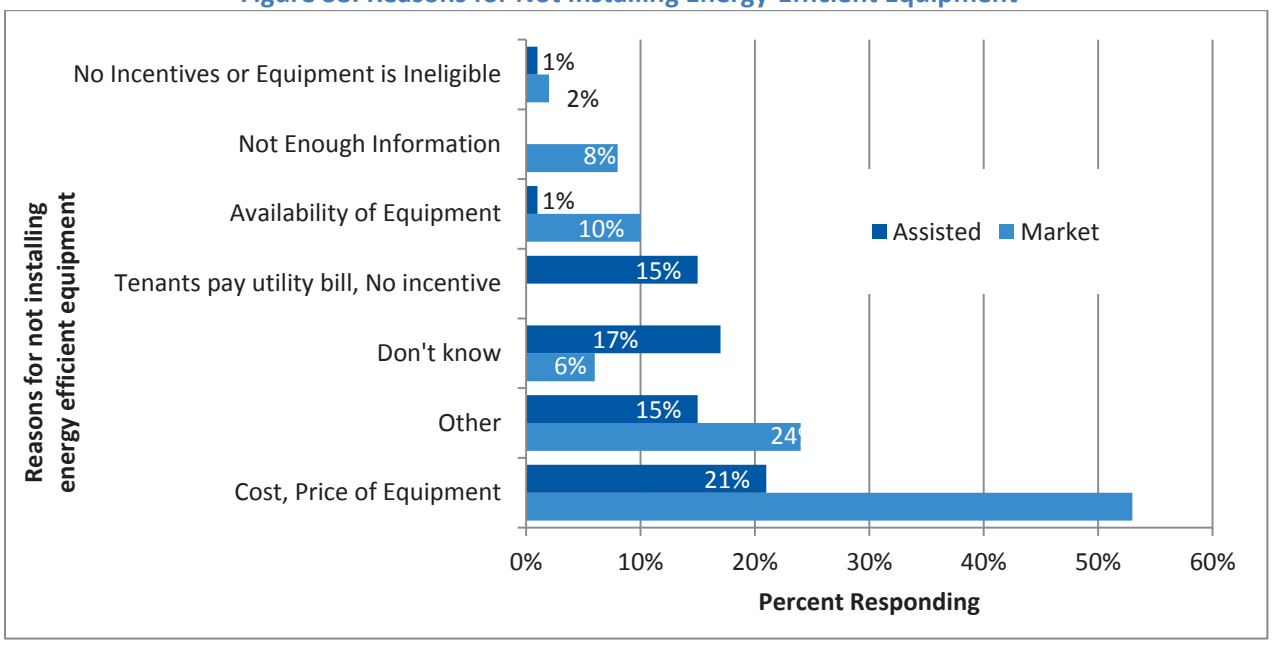


When asked who pays for the lighting and equipment upgrades made to the tenant apartment units, the majority, 81%, said the property owners pay for the equipment upgrades in tenant units, 11% said both the tenant and owners pay or it depends on the situation, and 7% said the tenant pays for upgrades.

We asked respondents if tenants owned any of the equipment within their units. We did not ask what percentage of tenants own each type of equipment, so we do not attempt to develop overall percentages from this data. Nevertheless, the responses are indicative that some low-income households do own major appliances; 29% of respondents said tenants own refrigerators, 14% of respondents said tenants own clothes washers, and 10% of respondents said tenants own room air conditioners.

Respondents reported they did not install energy-efficient equipment largely because of the price: 53% of managers and owners of market rate, and 21% of rent-assisted buildings. Those in the "other" category stated that energy efficiency equipment is not as durable, they follow state policies, it is *"just basic stuff,"* and there is no benefit from installing energy efficient equipment in the apartments. The next largest response for the rent-assisted group, 17% said they did not know and 15% said the tenants pay the bills and there was no incentive for the owners to install efficient equipment.

Figure 38. Reasons for Not Installing Energy-Efficient Equipment



Benefits from Common Area Upgrades

Survey respondents who have common areas on the property were asked to identify the ways they thought reducing energy use in common areas benefits owners and tenants. Respondents said the top benefit for owners was to save money and reduce costs (Table 23). Over one-quarter said there were no benefits to owners. The two sectors differed with only 4% of rent-assisted respondents saying there were no benefits and 32% of market rate respondents saying this.

Forty-three percent of respondents said that there were no benefits to tenants for making energy efficiency upgrades in common areas (Table 24). Market rate respondents said this more frequently (44%) than respondents in the rent-assisted sector (34%). The top benefits for tenants were saving money for tenants (29%), tenant comfort level (10%), and being good for the environment (6%). Other benefits accounted for 5% of the responses. These responses included better lighting, decreased utility costs, tenants learn about energy efficiency, more efficient home, offer more programs to tenants, and keeping rent down.

Table 23. Benefits of Energy Efficiency Upgrades in Common Areas to Property Owners*

Benefits	Weighted Base	Rent Assistance	Market Rate
Save money for owners/reduce costs	55%	88%	50%
No benefit to owners	28%	4%	32%
Increase property value	6%	8%	6%
Other	5%	8%	5%
Good for the environment	4%	5%	4%
Improve cash flow	3%	11%	2%
More money for capital expenses	3%	11%	2%
Nicer building/more comfortable	2%	4%	2%
Don't know	9%	4%	10%

* n=104. Percentages do not add up to 100 because respondents could give multiple responses.

Table 24. Benefits of Energy Efficiency Upgrades in Common Areas to Tenants*

Benefits	Weighted Base	Rent Assistance	Market Rate
No benefits to tenants	43%	34%	44%
Save money for tenants	29%	39%	28%
Nice building/more comfortable	10%	8%	10%
Good for the environment	6%	1%	6%
Lower rent	5%	8%	4%
Other	5%	12%	3%
Not raise rent	3%	4%	3%
Don't know	8%	4%	9%

* n=104. Percentages do not add up to 100 because respondents could give multiple responses.

Table 25 compares two response options about the benefits from upgrading common areas: benefits to property owners or tenants and saving money for owners or tenants (Table 25). Almost half of the responses indicating there was no benefit to owners for making common area upgrades indicated that there was also no benefit to tenants in making these upgrades. A majority of the responses indicated that upgrades in common areas save money for tenants and owners (83%).

Table 25. Comparison of Benefits to Owners and Tenants

	No benefit to tenants	Save money for tenants
No benefit to property owners (n=57)	48%	13%
Save money for property owners/reduce costs for owners/reduce operating costs (n=29)	45%	83%

Decision Making

Surveyors asked respondents who makes the decisions about improvements or purchasing new heating and cooling equipment for their multifamily properties. This question was answered by 96 respondents (a weighted base), including 32 representing rent-assisted and 64 representing market rate apartments. The majority of all respondents, 87%, stated the owner or manager made these decisions. Of those representing rent-assisted properties, 63% stated the owner or manager made decisions, followed by 27% reporting directors made property decisions. Of those representing market rate housing, 88% stated the owner or manager made decisions, followed by 9% reporting directors made decisions.

Table 26. Decision Makers

Decision Maker	Weighted Base*	Rent Assistance*	Market Rate*
Owner or manager	87%	63%	88%
Director	10%	27%	9%
Facilities manager	4%	10%	3%

* Percentages were rounded.

When asked about the ownership structure of the property, 54% of respondents said an individual owned the property (Table 27). This was most common for properties discussed in the survey that had between 5 and 24 units (58%) and for properties with between 25 and 249 units. A corporation (66%) was the most common ownership structure for larger buildings (250+ units on the property).

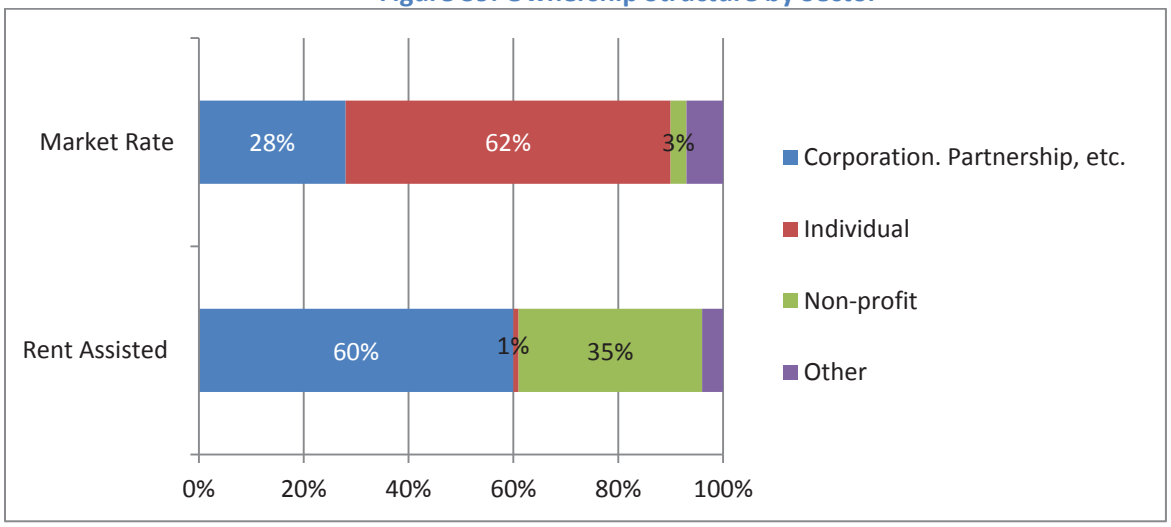
Table 27. Ownership Structure by Size (Number of Units in Buildings Discussed in Survey)*

	Weighted Base	5-24 Units	25-249 Units	250+ Units
Individual	54%	58%	44%	32%
Corporation, partnership, LLC, limited partnership	31%	26%	40%	66%
Non-profit institution	7%	8%	5%	-
Private institution	1%	2%	< 1%	-
Public institution	1%	2%	-	1%
Other	5%	4%	7%	-
Don't know	< 1%	-	1%	-
Refused	2%	2%	1%	-

* Weighted percentages were rounded.

The ownership structure for market rate and rent-assisted sectors are quite different. Individuals own the majority of market rate properties (62%), followed by corporations, which own 28% of properties. Corporations own the majority of rent-assisted properties (60%), followed by non-profits, which own 35% of properties. We assume that ownership of the specific multifamily property discussed in the survey is indicative of all units owned or managed by these respondents in California.

Figure 39. Ownership Structure by Sector



When asked if this decision making process changed when making major decisions for new buildings versus older buildings, 13% did not know. However, of those who had both new buildings and older buildings and who could answer, the majority, 83%, stated the process did not change. Another 10%

stated it depends, and major decisions were directed to the board. Several commented that they try to make older buildings more energy efficient, put in more efficient equipment, look at upgrading the building versus getting rid of the building, or tend to make major improvements in older buildings.

Surveyors asked respondents if they made decisions one building at a time or for the whole portfolio at the same time. The majority of all respondents (75%) reported decisions were made one building at a time. This differed between the rent-assisted respondents (33%) and market rate respondents (77%). More rent-assisted properties, 46%, reported making decisions for the whole portfolio. Only 21% of rent-assisted properties said they make decisions for the whole portfolio. Differences in responses between the two groups were statistically significant.

Table 28. Are Decisions Made One Building at a Time or for the Portfolio?

Are decisions made one building at a time or for the whole portfolio?	Weighted Base	Rent Assistance	Market Rate
Each building	75%	33%	77%
The whole portfolio	14%	46%	12%
It depends	7%	21%	6%
Don't know	5%	0	5%

As a whole, property owners and managers tend to spend money on major improvements (like installing a heating or cooling system) when it breaks (70%) rather than planning for it (17%). However, separating the two respondent groups, 44% of rent-assisted housing managers and 73% of market rate housing managers spend money when equipment breaks (statistically significant, p=.08). Rent-assisted housing owners and managers (23%), and market rate housing owners and managers (16%), plan ahead to spend money on major improvements.

When asked how far in advance they plan for something like a new heating or cooling system, 40% plan less than one year before the project begins, 26% said they plan between one and two years in advance, 1% plan between two and three years in advance, and 5% plan more than three years in advance. Another 14% of respondents did not know how far in advance expenditures were planned.

Table 29. Planning for Upgrades

How far in advance do you plan for something like a new heating or cooling system?	Weighted Base	Rent Assistance	Market Rate
Less than 1 year before the project begins	40%	25%	43%
1 year to less than 2 years	26%	38%	24%
2 years to less than 3 years	1%	10%	
3 years or more	5%	5%	5%
Varies	7%	11%	7%
Don't know	14%	10%	15%
Refused	6%	-	7%

The surveyor asked respondents how they paid for equipment replacements and upgrades. The questions were:

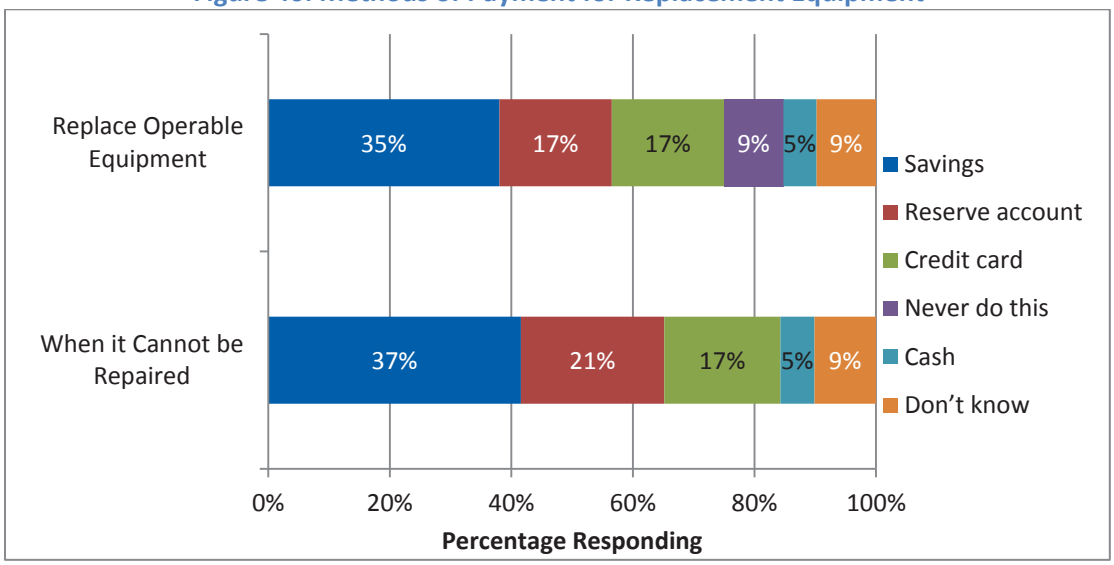
> *"When equipment like heating systems or water heaters are broken and can't be repaired, does your company take out a loan, charge the expenses, or use savings for the replacements?"*
>
> *"How about if you are replacing or upgrading old equipment that may still work? Does your company take out a loan, charge the expenses, or use savings for the replacements?"*

Responses were open ended (that is, the surveyor did not read the response options). These two scenarios result in similar approaches to payment.

As a whole, owners and managers reported they would pay for replacing or upgrading old but ***operable*** equipment with savings (35%), credit card (17%), and reserve account (17%). Another 9% reported they never replace old but operable equipment.

Respondents reported how they paid for equipment replacements like heating systems or water heaters when the system is inoperable. Respondents pay for placements of ***inoperable*** equipment with savings (37%), reserve account (21%), and credit card (17%).

Figure 40. Methods of Payment for Replacement Equipment



When equipment is inoperable, the two sectors approached paying for equipment replacements differently. Rent-assisted housing uses a reserve account (20%), credit card (23%), and savings (12%). Market rate housing uses savings (40%), credit card (16%), and reserve accounts (21%).

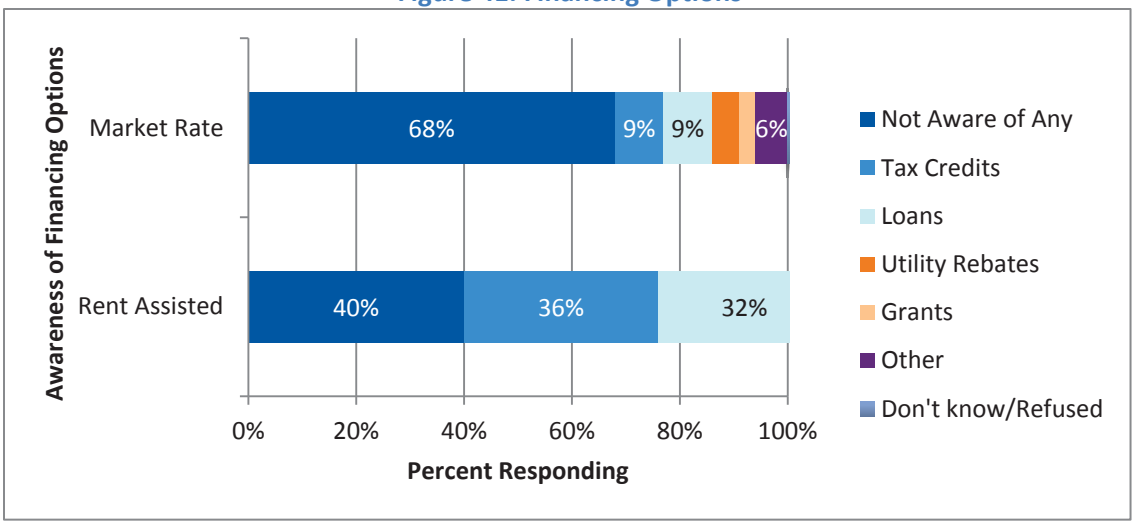
The two sectors also approach paying for upgrades of operable equipment differently. Rent-assisted housing uses a reserve account (46%), followed by credit card (23%), and savings (9%). Market rate

housing uses savings (38%), reserve accounts (13%), and credit card (17%). Differences between the two sectors were statistically significant for reserve accounts (p=.01) and savings (p=.09).

Surveyors asked respondents if they were aware of any financing options that may assist with the expenses to upgrade or replace equipment. The majority, 65%, said they were not aware of any. Others said they were aware of tax credits (12%), loans (12%), utility rebates (6%). The two groups had different levels of awareness: 40% of rent-assisted housing owners and managers were not aware of financing options, and 68% of market rate housing owners and managers were not aware of any options (Figure 41).

Tax credits were mentioned by 36% of owners and managers of rent-assisted housing, while this was mentioned by only 9% of market rate housing owners and managers (statistically significant difference, p=.02). Loans were mentioned by 32% of rent-assisted housing, and by only 9% of market rate housing owners and managers (statistically significant difference, p=.05). Utility on-bill financing was mentioned by 2% of all respondents. Other financing options mentioned by one person were Property Assessed Clean Energy program (PACE) and Power Purchase Agreement's (PPAs).

Figure 41. Financing Options



The most important factor in the decisions made when selecting equipment to upgrade or replace was cost (76% for the group as a whole; 93% of rent-assisted housing and 75% of market rate housing). The second most important factor for the group as a whole was energy efficiency (32%), followed by availability of equipment (20%), and then the size of the upgrade or improvement (14%).

For the two groups separately, 53% of the owners and managers of rent-assisted housing stated energy efficiency was a factor, 42% said the size of the upgrade or improvement was a factor, 24% said availability of equipment was a factor. Energy efficiency was a factor reported by 31% of market rate owners and managers, availability of equipment was mentioned by 19%, and size of the job was a factor

for 13%. The only statistically significant difference between the sectors was the size of the upgrade or improvement (p=.01).

Table 30. Factors Influencing Decisions to Select Equipment

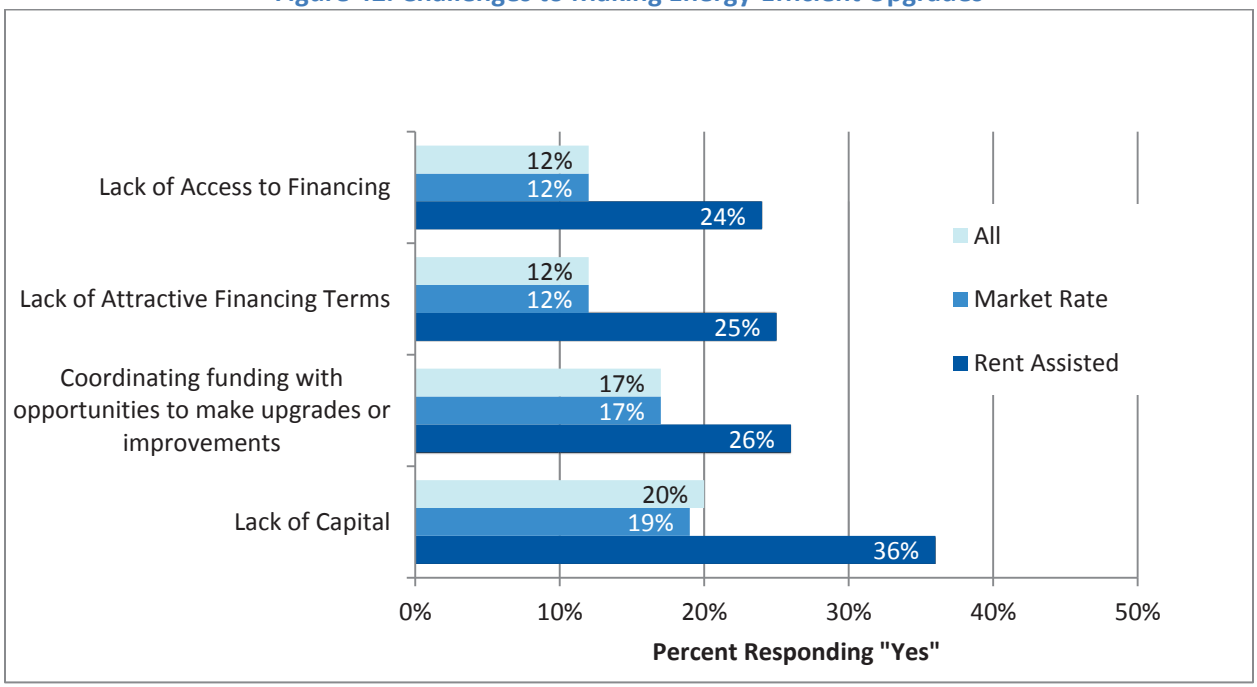
When you replace or update old or broken equipment, what factors influence your decision to select the equipment you install?[1]	Weighted Base	Rent Assistance	Market Rate
Cost	76%	93%	75%
Energy efficiency	32%	53%	31%
Availability of equipment	20%	24%	19%
Size of upgrades/improvements	14%	42%[2]	13%
Various: quality, tax credits, customer or contractor, reliability, matching old equipment, payback, prior experience, etc.	23%	6%	24%

1. Respondents could provide more than one response.
2. Statistically significant, p=.01

Surveyors asked respondents if specific factors made it difficult to make energy efficiency upgrades. The factors included lack of capital, lack of access to financing, lack of attractive financing terms, and coordinating funding with opportunities to make upgrades or improvements. About half the respondents reported that the factors did not make it difficult to make energy efficiency upgrades. The factor causing the most difficulty was the lack of capital (20% of all respondents; 36% of managers and owners of rent-assisted properties). Almost one-third of respondents also stated they did not know or refused to answer.

One quarter of the managers and owners of rent-assisted properties stated each of the other factors made it difficult to make energy efficiency upgrades. Among the managers and owners of market rate properties, 12% to 17% of respondents stated each factor made it difficult to make energy efficiency upgrades (Figure 42).

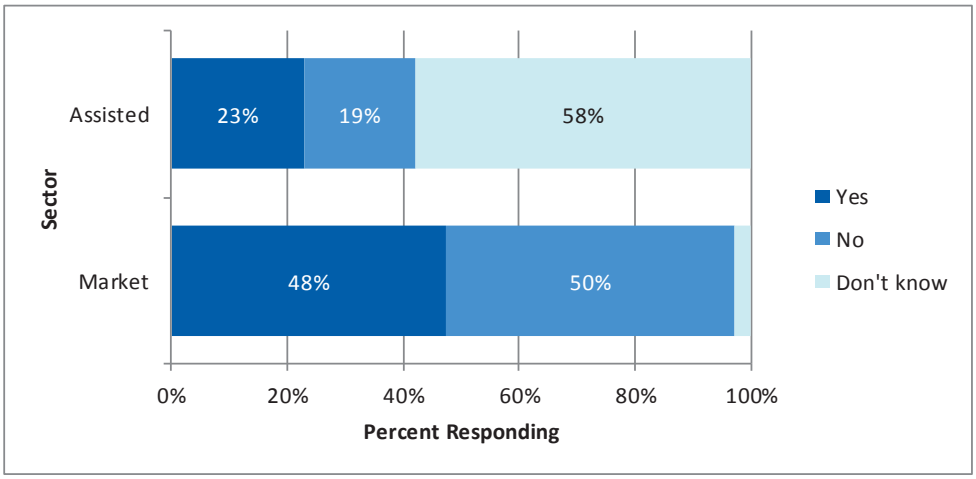
Figure 42. Challenges to Making Energy-Efficient Upgrades



The property owner (81%) pays the majority of costs for improvements to the building and apartment units. Otherwise, depending on the specific measure, the tenant may pay replacement costs.

About half the survey respondents reported their company had taken advantage of utility rebates. Programs and rebates mentioned included the ESA program, MASH, weatherization, lighting, showerheads, ceiling fans, energy audits, refrigerators, weatherstripping, and water efficiency measures. Breaking out the responses by sector, about half (48%) of respondents managing market rate properties responded they have taken advantage of rebates, and 23% of rent-assisted properties said they had. Another 58% of rent-assisted properties said they did not know if their company utilized utility rebates.

Figure 43. Respondents Participation in Utility Rebate Programs



Decision Making Key Findings

Overall, the majority (87%) of property managers and owners are the decision makers when it comes to building upgrades or replacing operable or inoperable equipment. When it comes to decisions about how to pay for upgrades to operable equipment or replacing inoperable equipment, the source of funds is similar, with 35% paying from savings, 17%-21% paying from reserves, and 15%-17% paying with credit cards. Only 5% of property managers and owners report using cash. The primary factor influencing decisions to make upgrades or repairs is cost (76%), with energy efficiency lagging, but ranking second (32%). When it comes to factors that make it difficult to make energy efficiency upgrades, lack of access to capital is the primary factor for both groups individually and for respondents as a whole (20%). The majority, 65%, said they were not aware of any financing options that may assist with the expenses to upgrade or replace equipment.

But the approaches taken by owners and managers of rent-assisted housing and market rate housing are different when making decisions one building at a time versus at a portfolio level, and in planning timelines. Market rate housing managers tend to make decisions one building at a time (77%) while rent-assisted housing managers tend to approach these decisions at the portfolio level (46%). Market rate housing managers tend to make decisions within one year of the expenditure for equipment upgrade or replacement (43%) while rent-assisted housing tend make these decisions one to two years before the project (38%).

The two groups also tend to use different funding sources to pay for equipment upgrades. When rent-assisted managers pay for upgrades when equipment cannot be repaired they use credit cards (23%), and then reserve accounts (20%), and savings 12%. When Market rate housing managers replace equipment that cannot be repaired they use savings first (40%), reserve accounts (21%), and then credit cards (16%).

Market rate managers use savings first for making upgrades for operable equipment (38%), and then credit cards (17%), and then reserve accounts (13%). Rent-assisted housing managers used reserve accounts first (46%) and then credit card (23%).

Both groups said that the top two factors influencing decision making about replacing equipment was cost and energy efficiency but energy efficiency was mentioned much less by market rate housing managers (31%) than by rent-assisted housing managers (53%). Rent-assisted housing managers mentioned size of upgrades as a top factor (42%) but this was mentioned less by market rate housing managers (13%).

Market rate housing managers were less aware of financing options than rent-assisted housing managers. Sixty-eight percent of market rate housing managers were not aware of financing options while 40% of rent-assisted housing managers were not aware.

Table 31 provides details about decision-making themes for both groups of housing managers.

Table 31. Decision-Making Profile Comparing Two Sectors*

Decision-Making Themes	Rent Assistance Housing	Market-Rate Housing
Decision Maker	63% of decision makers are owners or managers and 27% are directors.	88% of decision makers are owners or managers and 9% are directors.
Decisions made one building at a time or for the portfolio	46% reported that decisions are made for the whole portfolio while 33% said decisions are made one building at a time.	12% reported that decisions are made for the whole portfolio while 77% reported that decisions are made one building at a time.
Planning for Upgrades	44% spend money when equipment breaks and 23% plan ahead.	73% spend money when equipment breaks and 16% plan ahead.
Planning Timeline	25% plan less than one year before the project begins while 49% said they plan between one and two years in advance.	43% plan less than one year before the project begins while 24% said they plan between one and two years in advance.
Payment for upgrades when equipment cannot be repaired	23% pay for upgrades with a credit card, 20% pay using a reserve account, and only 12% use savings.	16% pay for upgrades with a credit card, 21% use a reserve account, and 40% use savings to pay for upgrades.
Payment for upgrading operable equipment	46% use a reserve account to pay for operable equipment upgrades, 23% use a credit card.	38% use savings to pay for upgrades, 17% use credit cards, and 13% use reserve accounts.
Awareness of financing options	40% were not aware of financing options. 36% were aware of tax credits.	68% were not aware of financing options. Only 9% were aware of tax credits.
Factors influencing decisions to replace or upgrade equipment[1]	Top factors were cost (93% of responses), energy efficiency (53%) and size of upgrades (42%).	Top factors were cost (75% of responses), energy efficiency (31%), and size of upgrades (13%).
Lack of capital	36% said this factor made it difficult to make upgrades.	Only 19% said this factor made it difficult to make upgrades.

* Respondents could provide more than one response.

We used the total number of apartment units the respondent owned or managed in California to classify respondents. Small refers to companies with between 5 and 24 apartments in California, medium refers to those with 25 to 249 units in California, and large companies are those with 250 or more units in California. This classification structure was based on the answer to two survey questions: number of units on the specific property discussed in the survey and the number of additional apartment units in California. If respondents did not know the exact number of additional apartment units, they were asked to identify the size range. If they did not know this, Cadmus conducted an Internet search to determine the size. If there was no information, we classified the survey based on the number of units on the property.

Table 32. Decision-Making Profile Comparing Three Property Sizes

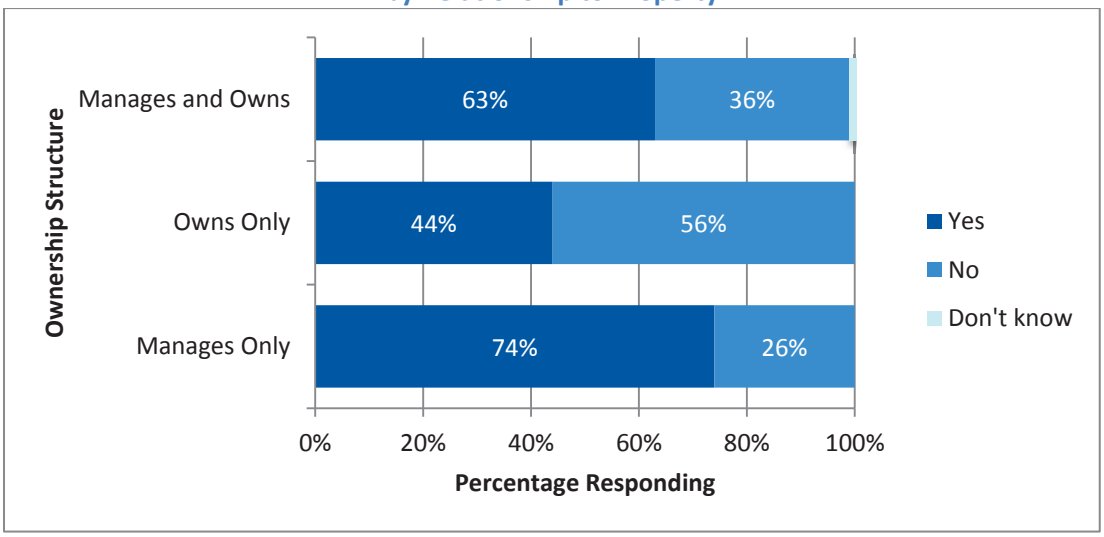
Decision-Making Themes	Large Properties	Medium Properties	Small Properties
Decisions made one building at a time or for the portfolio	24% reported that decisions are made for the whole portfolio, while 44% said decisions are made one building at a time.	12% reported that decisions are made for the whole portfolio, while 83% reported that decisions are made one building at a time.	14% reported that decisions are made for the whole portfolio, while 72% reported that decisions are made one building at a time.
Planning for Upgrades	51% spend money when equipment breaks and 21% plan ahead. 28% do both.	71% spend money when equipment breaks and 22% plan ahead. 5% do both.	73% spend money when equipment breaks and 10% plan ahead. 10% do both.
Planning Timeline	55% plan less than one year before the project begins while 23% said they plan between one and two years in advance.	31% plan less than one year before the project begins while 25% said they plan between one and two years in advance.	44% plan less than one year before the project begins while 33% said they plan between one and two years in advance.
Payment for upgrades when equipment cannot be repaired	25% pay for upgrades with a credit card, 29% pay using a reserve account, and only 11% use savings.	7% pay for upgrades with a credit card, 24% use a reserve account, and 42% use savings to pay for upgrades.	26% pay for upgrades with a credit card, 15% use a reserve account, and 38% use savings to pay for upgrades.
Payment for upgrading operable equipment	25% pay for upgrades with a credit card, 21% pay using a reserve account, and only 11% use savings.	10% pay for upgrades with a credit card, 12% use a reserve account, and 35% use savings to pay for upgrades.	24% pay for upgrades with a credit card, 21% use a reserve account, and 40% use savings to pay for upgrades.
Awareness of financing options	58% were not aware of financing options. 12% mentioned loans and 5% tax credits.	69% were not aware of financing options. 12% were aware of tax credits and 8% loans.	61% were not aware of financing options. 14% were aware of tax credits and 16% loans.
Factors influencing decisions to replace or upgrade equipment*	Top factors were cost (69% of responses), energy efficiency (14%) and size of upgrades (10%). Mentions: codes, quality, using same equipment.	Top factors were cost (82% of responses) and energy efficiency (27%). Mentions: quality, warranties, equipment size.	Top factors were cost (70% of responses), energy efficiency (43%) and size of upgrades (23%). Mentions: using comparable equipment.
Lack of capital	14% said this factor made it difficult to make upgrades.	Only 17% said this factor made it difficult to make upgrades.	Only 24% said this factor made it difficult to make upgrades.

* Respondents could provide more than one response.

Program Awareness and Participation

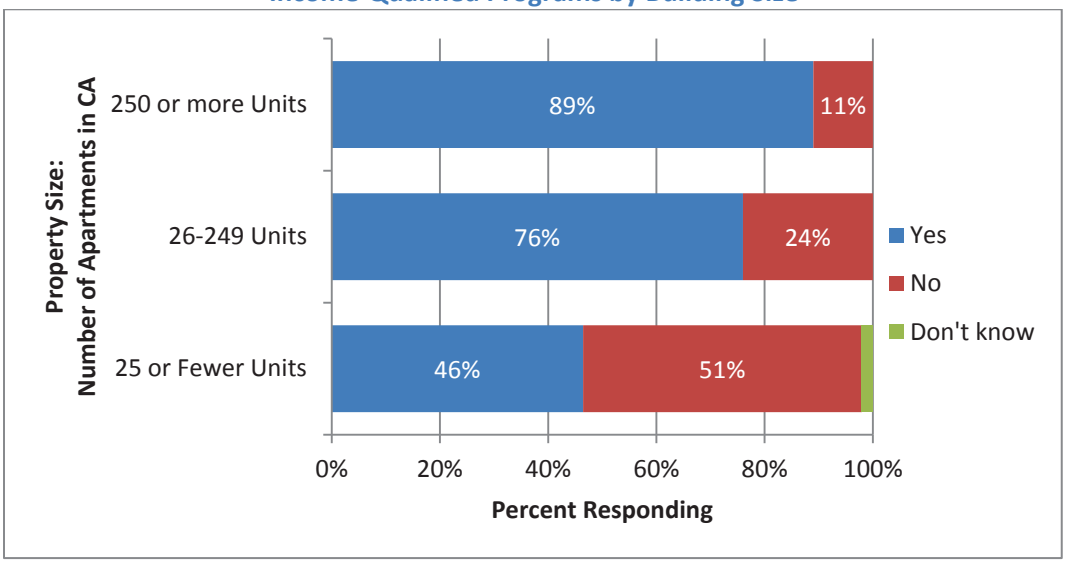
About 65% of survey respondents said they had heard of programs offered by utilities that provide income qualified households with free equipment and services related to energy efficiency. The percentage was higher among respondents who manage the property than among respondents who own the property but do not manage it. As shown in Figure 44, only 44% of respondents who owned by did not manage the property were aware of income-qualified programs.

Figure 44. Respondents Who Have Heard of Income-Qualified Programs by Relationship to Property



Respondents in the market rate sector were more likely to have heard of utility-sponsored income-qualified programs, with two-thirds having head of them; only 40% of respondents from the rent-assisted sector had heard of such programs. Managers of larger buildings are more likely to have heard of utility-sponsored income-qualified programs, as shown in Figure 45.

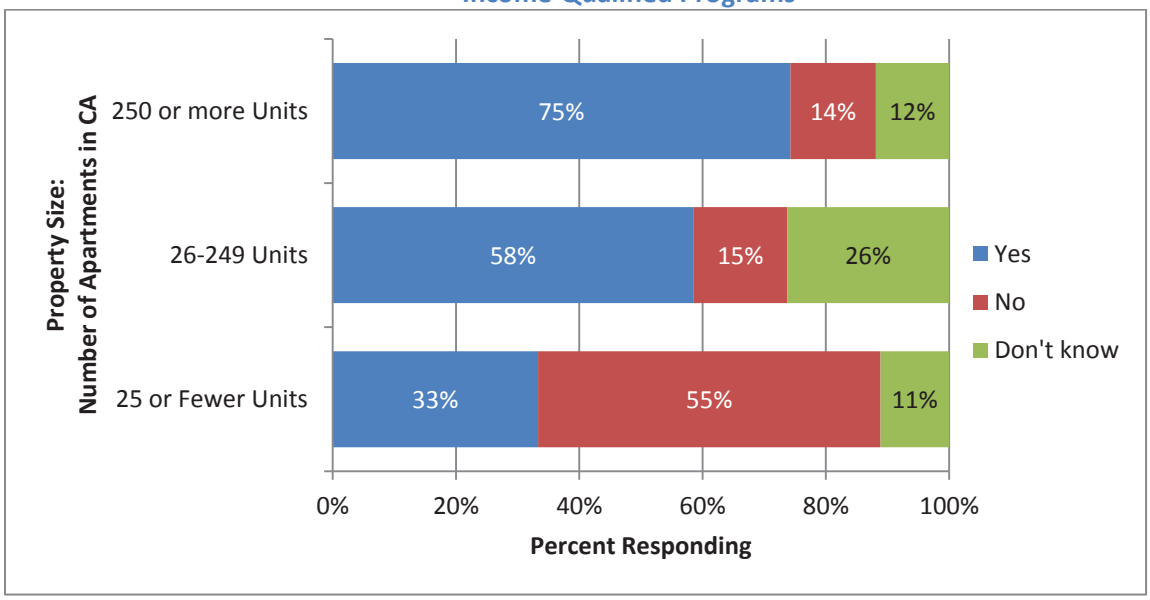
Figure 45. Respondents Who Have Heard of Income-Qualified Programs by Building Size



Overall, about 50% of respondents who were aware utility-sponsored income-qualified energy efficiency programs said that some of their tenants had taken advantage of them. Eighteen percent of respondents said they did not know whether tenants had participated; however, 54% of respondents who only own the building but do not manage it, said they do not know whether tenants have participated.

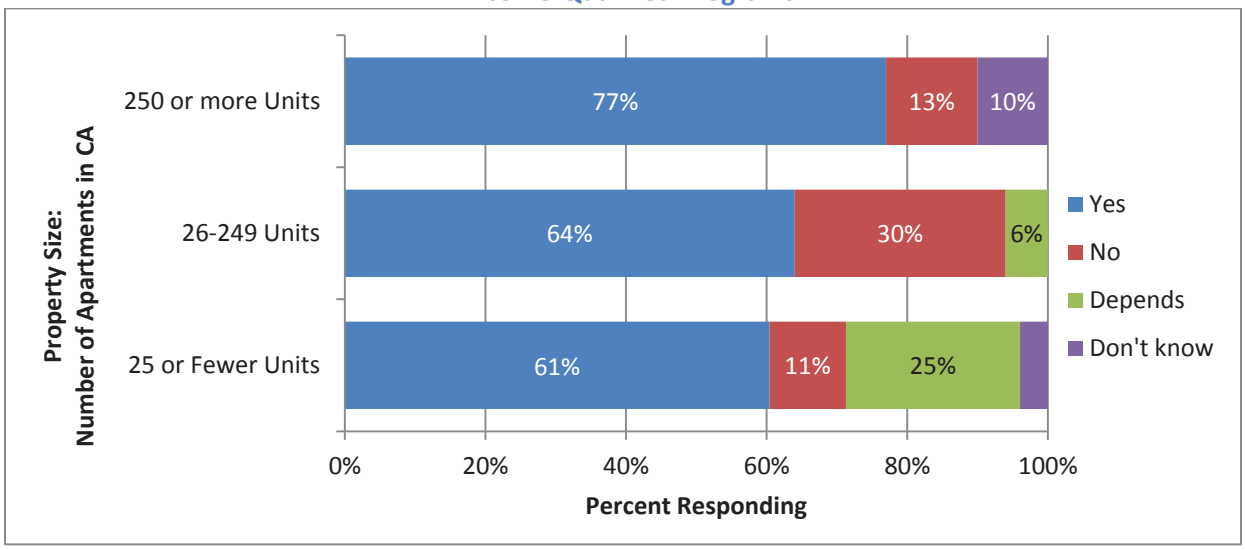
Among respondents who own or manage market rate buildings, 58% of respondents said some of their tenants had participated in income-qualified programs. Among respondents who manage rent-assisted properties, only 7% said their tenants had participated (statistically significant difference, p=.01). Owners and Managers of larger buildings were more likely to report their tenants have participated in income-qualified programs.

Figure 46. Aware Respondents Who Said Tenants Had Participated in Income-Qualified Programs



Surveyors asked respondents if they would be supportive of tenant participation in utility-sponsored income-qualified programs, even if they would have to fill out paperwork and allow contractors not hired by their company to have access to the property. The majority, 64%, said they were supportive. Another 20% of respondents said they would not be supportive of participation under those circumstances; and 13% of respondents said their support would depend upon specific circumstances related to paperwork or building access. These percentages did not differ significantly between the market rate and rent-assisted sectors; however, as shown in Figure 47, owners and managers of larger numbers of units were more likely to say they would be supportive of the program.

Figure 47. Respondents Who Said They Would Support Tenant Participation in Income-Qualified Programs



Interviews with Stakeholders and Advocacy Groups

Cadmus interviewed the owners and managers of market-rate housing and assisted housing.

Summary of Key Findings

Cadmus conducted interviews with low-income stakeholder and advocacy groups working with affordable and market-rate multifamily housing, and multifamily building owners and managers. We conducted 16 separate interviews with 18 people from 14 different stakeholder organizations. Of these, eight organizations had attended the Multifamily Segment Study public workshop in March 2013 and six had posted comments to Decision 12-08-044. We collected information about the respondents' constituency, financing considerations for multifamily building improvements, and discussed concerns about participation in the ESA Program.

Appendix G details the research methodology and sample frame for these interviews with low income stakeholder and advocacy groups working with market rate and/or rent-assisted multifamily buildings.

Because the Cadmus team conducted guided interviews with these stakeholders rather than surveys, we do not report frequencies for responses for each topic. Instead, we identified themes that could affect the ESA Program. This section synthesizes stakeholder experiences and perceptions, and responses may not reflect the ESA Program as implemented from the IOU's perspective.

The key interview topics we addressed were these:

1. Financing and investment structures
2. ESA Program enrollment
3. Implementing energy-efficiency retrofits in multifamily buildings
4. Suggestions for others who could be interviewed or surveyed (specifically, we sought contact lists of multifamily building owners and managers)
5. Organizations or other resources that could provide information about owners of low-income condominiums and apartments
6. Suggestions for additional research

Financing and Investment Structures

Respondents provided background about and insights into the financing and investment structures as they discussed their considerations related to energy-efficiency upgrades in multifamily buildings. Five respondents spoke of how the timing of upgrades with respect to building maintenance and larger-scale property rehabilitation can affect the decisions of building owners and managers.

One respondent explained how the key to identifying opportunities to make energy-efficiency upgrades is to have an understanding of two primary financial events.

- ***Asset management events for ongoing operations and maintenance activities.*** Equipment replacement is typically an asset management activity, as it does not occur on a large scale within one building at the same time. Equipment upgrades are usually made a few units at a time, such as when a specific piece of equipment fails or when a unit turns over.
- ***Recapitalization events, involving a restructuring of the property debt.*** During these events, the entire property may be rehabilitated. Thus, in addition to non-energy-efficiency capital improvements, building owners could make whole-building energy-efficiency upgrades at this time. (For example, all room air conditioners or refrigerators or central HVAC equipment could be upgraded.)

Since the recapitalization events tend to occur on a 15- to 20-year cycle, one respondent said it provides an opportunity to layer in funding resources for energy-efficiency upgrades. Two respondents offered examples of collaborating successfully with IOUs to synchronize their recapitalization events with the utilities' energy-efficiency programs. This collaboration improved their resource averaging (reduced per-unit cost of resources used throughout their project) and resulted in cost-effective energy savings. These respondents would like to see the ESA Program foster this level of collaboration.

Respondents representing affordable housing mentioned the importance of long-term planning for financing building upgrades. One stakeholder plans projects as far ahead as 40 years to allow for adequate cash reserves.

Financing Considerations

All respondents reported that multifamily property owners and managers use a layered approach to financing large retrofits and energy-efficiency improvements. The financing methods typically depend on these factors: (a) whether a property rents units at the market rate or at an affordable-housing rate, and (b) where the building is within its investment and life cycle.

Specifically, respondents reported that the financing methods routinely used are these:

- For subsidized multifamily housing, the building owners and managers tend to use HUD funds, grants, rebates, tax credits (for new buildings or solar upgrades), and cash reserve accounts.
- For market-rate multifamily housing, the building owners and managers depend primarily on cash accounts and use a combination of bank loans, real estate investment trusts, and joint-venture partnerships.
- For small multifamily market-rate housing, the property owners may also use traditional bank loans (rather than loans from a savings and loan bank, a credit union, or a mutual savings bank).

Four respondents said that financing for affordable multifamily housing is particularly complicated and it can be difficult to figure out the many layers of funding and associated requirements. As shown in Table 33, the stakeholders described some of the financing differences between affordable-housing and market-rate housing for multifamily buildings.

Table 33. Affordable and Market-Rate Financing Considerations as Described by Respondents

Finance Themes	Affordable Housing	Market-Rate Housing
Funding Combination	Uses HUD funds, grants, rebates (and tax credits for new construction or solar upgrades). May use cash reserves and/or short-term financing.	Uses a combination of bank loans, real estate investment trusts, and joint venture partners. (Note that small multifamily building owners tend to use traditional bank loans.)
Cash flow	Affordable-housing rents often do not provide sufficient cash flow to finance improvements.	Market-rate rents may provide sufficient capital for financing building improvements.
Restrictions	More restrictions regarding improvements that can be made with specific funding sources. Also, there tend to be regulatory requirements as to which improvements can be made and how they are made.	More flexibility making decisions about which improvements to make; also, the decisions are subject to investor/funder approval.
Project reserve funds	May fund improvements with project reserves. However, these reserves may be subject to approval by lenders and investors.	May fund improvements with project reserves. Improvements may be subject to approval by lenders and investors.
Leasing options	Leasing equipment is very complex because there are multiple layers of regulation and funding. Also the leasing process may be too time-consuming to utilize for adding energy-efficient equipment.	Leasing is an option for adding energy-efficient equipment.
Available financing resources	Programs and grants are available for affordable-housing improvements.	Few resources and programs are available for market-rate housing improvements.

Many properties have multiple investors, each requiring a separate approval process. As noted in Table 33, most property owners and managers must obtain approval from investors before making upgrades that will increase debt to the property. In addition, the investor approval process tends to be affected by the type of improvement under consideration. Specifically:

- Replacing equipment at the end of its useful life is covered by the operations and maintenance budget.
- Upgrading equipment to a more energy-efficient model across the entire property (regardless of whether the equipment to be replaced has reached the end of its useful life) can require funding beyond the resources provided by the cash flow or project reserves in multifamily housing. In these instances, other means of financing may be needed to complete the project.

Respondents explained that to avoid creating subordinated debt on a property, other financing approaches—such as on-bill loans and leasing—are sometimes used.

Use of Tax Credits

Two respondents said that tax credits work well for new construction, but such credits can be very difficult to obtain when a building is in operation. One respondent said that the investors who fund the property's construction often plan to exit the partnership after 10 or 15 years and use their capital for other investments.

Concerns and Barriers about Financing and Investment in Energy Efficiency

The key messages from respondents regarding barriers to financing energy-efficiency improvements were the following:

Coordination with the IOUs

More coordination with the IOUs is needed for the scaling and timing of major multifamily building upgrades that receive funding through the ESA Program or another IOU-sponsored program.

During recapitalization, there tends to be a limited window of time appropriate for adding energy-efficiency improvements.

Project Costs and Payback

Although respondents did not define cost-effectiveness, they said that the savings must be cost-effective so the investment in energy efficiency is worthwhile. Five respondents stated that a long payback period on energy savings is a barrier for building owners. Two respondents stated energy savings were not as immediate or as high as expected. One respondent said the amounts available for financing (through utility programs) need to be substantial enough for owners to spend the time and resources to make energy-efficiency improvements.

- When property owners and managers must pursue multiple programs to get a small amount of work done, the effort (in terms of staff resources and coordination) may be cost-prohibitive. Thus, some managers choose not to participate.
- When the cost-per-building of a major rehabilitation project is substantial, then it is worth the time and expense for owners to get permission from the multiple investors supporting that property.
- Long-term payback on energy savings (more than five years) makes it difficult to justify the investment in energy-efficiency upgrades.

One respondent said rents paid in multifamily affordable-housing do not provide an adequate source of funding for energy-efficiency upgrades.

One respondent said there is a need for more flexible financing options available to multifamily building owners during recapitalization periods if they are to take on energy-efficiency upgrade projects.

One respondent pointed out that energy-efficiency and aesthetics are the top two considerations when replacing equipment, partly because that is what tenants want, even though it may not directly benefit the building owner in terms of cost or energy savings.

Financing Awareness and Options

Several respondents told us multifamily building owners are not aware of all the financing options available to them.

One respondent pointed out that some programs do not work well with mixed-use properties. That is, financing is problematic when a building contains both market rate and affordable units.

According to one respondent, there are limited options for market-rate multifamily building owners to finance energy-efficiency improvements. Two respondents said that energy-efficiency is not required for financing upgrades in market-rate properties. That is, there is a lack of drivers for energy-efficiency built into the requirements to obtain funding for market-rate building retrofit projects.

According to one respondent, unsecured financing (not tied to equity in the building) may be a possible approach, but few unsecured financing options available to multifamily owners. Also, since this approach is rarely used, there is a lack of adequate data on the risks associated with unsecured financing.

Regulatory Issues

Respondents stated that some barriers to investing in affordable multifamily housing are a result of current regulatory agreements for each funding source that make it difficult for multifamily owners to take on additional debt (create subordinated debt). The key barriers of this type brought up by respondents are these:

- It is difficult for multifamily affordable-housing buildings to add supplemental loans because of complex nature of the requirements for the existing funding package for each property.
- To obtain funds for building improvements on multifamily affordable housing, the improvements must increase the building's energy efficiency as a result of the entire project.

One respondent said that meeting the tax credit and state regulatory requirements combined with the complex process to fund upgrades is the largest obstacle.

Strategies to Address Financing and Investment in Energy Efficiency

Not surprisingly, most respondents recognized that the multifamily property owners tend to prefer financing solutions that do not require a large outlay of funds and do not create subordinated debt.

Five respondents discussed options such as tax liens and on-bill financing (OBF) mechanisms as promising solutions to funding multifamily energy-efficiency retrofits. With these options, the debt remains with the property, or transferred with ownership of the building. Owners may choose to pass the debt to tenants. In addition, respondents stated OBF levels the costs of an improvement over a long time and embeds the costs in building operations, but without creating subordinated debt.

These respondents said they were eager to see the results of large retrofit projects funded through OBF, although they did not specify a particular project funded with OBF.

The financial strategies recommended most frequently by respondents for making energy-efficiency upgrades are listed in Table 34.

Table 34. Financial Strategies Recommended by Respondents

Financial Strategy	Description
On-Bill Financing	The owners pay for the improvements over time through utility bills, and they do not need to increase debt secured by the property. The OBF stays with the property, becoming part of the operations cost. • For master-metered accounts, the costs may be passed on to tenants or transferred to new owners. • For individually metered accounts, the cost can be included on the tenant's utility bill as an "on-bill refinance cost for energy-efficiency," which can also be passed on from tenant to tenant.
Power Purchase Agreements (PPA) and solar leases	PPAs provide the financing for solar projects by creating a contractual relationship between the owner of the property that generates electricity with the installed solar equipment and the power company that purchases that power. A solar lease is an agreement between the solar consumer and the developer who owns the solar equipment. In this arrangement, the consumer pays the developer for the electricity generated by the equipment, and the consumer's electricity costs are typically lower than conventional utility rates. Stakeholders cited the California Solar Initiative (CSI) and federal investment tax credits as possible models of successful financing options used by these programs.
Packaging energy-efficiency loans for purchase by secondary markets	A recently launched example of this strategy in California is the Warehouse of Energy Efficiency Loans (WHEEL), an entity that purchases energy-efficiency loans from loan originators (state and local), pools them, and sells them into secondary markets. WHEEL creates the scaling needed for repackaging energy-efficiency loans, which frees state and local resources for more energy-efficiency loans.
Tax Liens	The cost of energy-efficiency upgrades becomes part of the tax bill and remains with the property, even if the ownership changes. Property Assessed Clean Energy (PACE) programs are an example of this strategy, as they enable local jurisdictions to finance energy-efficiency upgrades through a property assessment (for qualifying properties). PACE programs are considered lower-risk financing strategies because the repayment of the loan is prioritized ahead of the mortgage on the property.

ESA Program Enrollment[43]

Respondents described their experiences with and knowledge of program-enrollment issues that create barriers to ESA Program participation. The key strategies respondents recommended for improving enrollment were these:

- Allowing HUD's income-qualified tenants (categorical eligibility) to be pre-qualified for the ESA Program to expedite the enrollment; and
- Simplifying the program processes (eligibility, application, and participation) to make it easier for tenants and building owners to understand and navigate (including having a single point of contact to address participant questions).

Concerns about ESA Program Enrollment

Nearly all interviewees mentioned barriers to enrolling in the ESA Program—barriers for tenants and for building owners seeking improvements to their buildings for the benefit of their tenants. The most significant perceived barriers were the lack of integration of multifamily energy-efficiency programs (sponsored by the IOUs and others) and the absence of contact people to help owners and managers leverage these programs to make whole-building retrofits. Two respondents reported that multifamily building owners, primarily in market rate buildings, do not necessarily know whether a tenant is low-income. One respondent explained that a third party contractor verifies tenant income-eligibility; therefore, the owner does not need to know which tenants are low-income.

Seven respondents reported that program participation is time-consuming for building owners and managers because of the effort involved in navigating the requirements of the various programs available (in terms of fuel source and measure, the oversight, administration, and management).

The key process concerns identified by respondents were these:

- No single point of contact to help property owners and managers determine the appropriate program for each phase of their whole-building rehabilitation projects.
- Inadequate integration between the ESA Program, Energy Upgrade California, and other programs to help property owners and managers address whole properties and achieve maximum energy savings. For example, performance incentives are needed to make the whole-building energy-efficiency retrofit project cost-effective for the owner. However, as one respondent stated, when the programs are not integrated, the first program utilized addresses the "low-hanging fruit," which then makes the whole-building upgrade project difficult to complete. It was perceived that the remaining upgrades alone would not meet the energy savings goals or qualify for the performance incentives.

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[43] Cadmus and Research into Action recognize the importance of stakeholder comments, which revealed that the perceptions of the interviewees do not always reflect the intent of the IOUs' program designers. We also note that the respondents may not be aware of or understand the reasons for differences in the IOUs' programs or why the programs operate as they do.

- The current ESA Program enrollment process results in the missed opportunity (for income-restricted housing) of making energy-efficiency upgrades while a unit is unoccupied. The main benefits of working on unoccupied units are: reduced administrative burdens; a lower cost for the logistics and the scheduling of upgrades; and, faster completion of the work.
- Low-income households that qualify for affordable housing probably participate in other low-income programs. If they do, they have been rigorously screened already and provided with the documentation to qualify.[44] However, streamlining the ESA Program enrollment process with a categorical eligibility option would be difficult because of the different income qualification guidelines.
- To repeat the tenant qualification process using different income guidelines is perceived as time-consuming and disruptive (to tenants). Due to fair housing laws, multifamily building owners—primarily in market rate buildings—do not always know whether a tenant meets the low-income qualifications.

Strategies to Address ESA Program Enrollment

Interview respondents recommended these high-level strategies to improve ESA Program participation by their multifamily building tenants and to address what they perceived as barriers.

- Respondents noted that if the income requirements of HUD's affordable housing guidelines and the ESA Program were compatible, then the enrollment process would be less time- and resource-intensive, as the ESA Program could have a categorical eligibility process in place. Thus, for example, HUD's income-qualified tenants would be pre-qualified for the ESA Program.
- To income-qualify a whole building, the property owners and managers currently verify that 80% of the units must house people who meet the income guidelines. Units could be upgraded when they are unoccupied, which would save both time and resources for the program, property owners, and managers. Income-qualified tenants could then move into units that are already upgraded, eliminating the challenges associated with upgrading occupied units.
- Strategically integrating the ESA Program with other programs (such as Energy Upgrade California[45]) would allow multifamily building owners and managers to address the needs for upgrades to the property as a whole, rather making small upgrades at potentially different times. Overlapping programs with different functions can work well together through better collaboration and coordination between multifamily building owners and utilities.
- By having a single point of contact for multifamily buildings that was knowledgeable about other energy-efficiency programs available in the area and possess expertise in funding resources, the ESA Program could significantly reduce or eliminate barriers to participation for this low-income customer segment.

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[44] Author's note: These low-income programs have varying eligibility requirements that do not necessarily align with the ESA Program requirements (see Section 6).

[45] Energy Upgrade California was designed to coordinate with the ESA Program; multifamily building owners are required to authorize the ESA Program to serve their income-qualified tenants.

Implementing Energy-Efficiency Retrofits in Multifamily Buildings

Currently, to address all aspects of a whole-building retrofit by funder and fuel source, the property owners and managers must become involved in multiple programs. Because these interview respondents did not perceive that the ESA Program addressed multifamily buildings as a whole, they mentioned the missed opportunities for energy savings. They also mentioned a desire for more coordination across multiple programs. Three respondents said that the lack of a whole-building approach makes it difficult to address multifamily building energy-efficiency from either the *"owner and manager-controlled, common area energy usage perspective"* or from the *"tenant-controlled energy usage perspective."*

Three respondents mentioned that it is difficult to discern how tenants benefit from energy-efficiency improvements to multifamily buildings rather than landlords and owners.

The respondents said that incentives are split between the tenants who could make their own energy-efficient upgrades under the ESA Program, and, the property owners and managers who make energy-efficient upgrades to common areas, typically funded through programs sponsored by utilities and others.

Respondents also said that property managers usually keep replacement units on hand in case there is a problem with the equipment. Thus, the program should allow for some backup units to replace equipment that fails or is damaged. Respondents perceive that Energy Upgrade California as a potentially successful example of implementing a whole-building approach.[46]

Concerns and Barriers to Implementing Energy-Efficiency Retrofits

Five respondents indicated that one barrier to implementing energy-efficiency retrofits in an entire multifamily property or portfolio is the lack of a whole-building approach. One respondent suggested that a custom approach to building audits would accommodate the various structures and types of large multifamily buildings. For example, the audit and recommended upgrades for 100 duplex units could be very different from the audit and recommended upgrades for 100 high-rise units.

Respondents said that incentives are split between property owners and managers on the one hand, and apartment dwellers on the other. That is, property owners and managers make energy-efficiency upgrades in the common areas (using funding provided by utility and other programs), and tenants receive upgrades to individual apartments (through the ESA Program).

Several respondents also noted the ESA Program measures do not include central domestic hot water systems and heating/cooling systems, which is a missed opportunity for energy savings. However, one stakeholder's perspective was that the central heating and hot water upgrades were the "low-hanging

[46] Author's note: no independent evaluation of the Energy Upgrade California program had been conducted as of September 2013.

fruit" already addressed by other programs, so multifamily building owners needed support for making upgrades beyond the common areas.

Three respondents expressed concerns about working with approved ESA Program contractors. Building owners have their own vendor qualification and quality control processes. When there is a problem with the work—or if the equipment is not installed correctly—multifamily building owners want a quick response and an assurance that the contractor will be accountable. They prefer to work with contractors with whom they have a long-standing business relationship. One respondent stated that they assumed all ESA Program contractors are vetted by the utility, and thus had no concern about their qualifications.

Strategies to Address Implementation of Energy Efficiency Retrofits

Two primary strategies emerged in discussions with this limited pool of respondents that they thought would help both affordable and market-rate multifamily building owners and managers implement energy-efficient retrofits for the benefit of their low-income qualified tenants. These were: (1) changing the ESA Program design to foster a whole-building approach, and (2) increasing coordination between IOUs and property owners and managers.

Using a Whole-Building Approach

Respondents said that having a whole-building approach would allow multifamily building property owners and managers to combine opportunities to make energy-efficiency upgrades during major retrofits. Specific strategies suggested by respondents were these:

- Enable utility program staff and multifamily building owners or managers to collaborate so that the retrofit program opportunities could be aligned with the timing of capital plans and financing efforts. For example, during planned recapitalization, all refrigerators in a building could be replaced with energy-efficient models.
- Add upgrades of central heating and hot water systems as eligible measures within the ESA Program. Two respondents said these are cost-effective opportunities for saving energy in multifamily buildings.
- Provide multifamily building owners with support to coordinate with IOUs when there are programs that have overlapping functions so that the common areas and the individual units can be treated (but not necessarily through the same program.)

Having Better Coordination among Stakeholder Groups

Respondents said that to work effectively with property owners and managers for major retrofits, utility ESA Program staff members need to understand how energy-efficiency upgrades impact daily operations and maintenance across affordable - and market-rate multifamily building portfolios.

Five respondents suggested optimized timing and coordination between multifamily building capital plans, financing opportunities, and the ESA Program would improve the program's relevance to owners and reduce costs. These respondents said that if IOUs designed their programs with the flexibility to synchronize with multifamily investment schedules, it would enable property owners and managers to scale their improvement efforts across an entire portfolio (whether affordable- or market-rate). For

example, one jurisdiction's Housing Authority collaborated with its local utility to replace 900 HVAC systems within a single affordable-housing portfolio.

Respondents mentioned the following factors affect coordinating retrofits:

- If energy efficiency is addressed across an entire housing portfolio, then asset management (unit turnover/maintenance and operations management) could be planned and appropriately scaled.
- To restructure debt and make capital improvements, many multifamily building owners refinance properties at year 15.
- HUD requires five-year capital plans, at which time major building investments are identified.

Suggestions of Others to Interview or Survey

During these interviews, the Cadmus team sought to obtain contact lists of multifamily building owners and managers. Most of the data sources named by stakeholders were already in the lists that Cadmus had compiled. Thus, we used this stakeholder information to confirm that our datasets were comprehensive.

Information Sources about Low-Income Owners of Condominiums and Apartments

None of the respondents recommended a specific source for information on low-income owners of condominiums and apartments. However, a few mentioned that there are advocacy groups that may know more about this population.

Respondents Suggestions for Additional Research

The Cadmus team asked stakeholders about research topics of interest. Most suggestions were already addressed by this study. The topics stakeholders suggested that are not addressed by this study are summarized here.

- **Data on master metered multifamily buildings.** The type of metering presents issues in terms of program implementation, data collection, and analysis of energy-savings. Currently, there is no existing data source for whole-building energy use (common meters and tenant meters together) in multifamily buildings. To help implement a whole-building approach with energy-efficiency upgrades, respondents recommended that we identify a data source or a method for determining which buildings are master-metered and which are individually metered. One respondent noted that the classification of master-metered multifamily buildings may limit eligibility for utility programs. For instance, in some states these buildings do not qualify for residential utility programs because they are considered commercial accounts. Another stakeholder wanted to know if tenants could be asked to report the benefits to their households of energy-efficiency upgrades, particularly in a master-metered building.
- **Affordable multifamily housing and utility regulatory policies impact multifamily housing financing.** Regulatory policies can have unintended effects on the financing of multifamily building improvements. One stakeholder said more research is needed about regulatory policies and how they potentially create barriers to securing multifamily housing financing. Additionally,

this stakeholder wanted to know: (1) how many states have a low-income adder (that is, what is the prevalence of this type of policy), and (2) what the non-energy benefits of energy-efficiency improvements are for tenants.

- **Energy-efficiency upgrades as part of large rehabilitation projects.** Because energy-efficiency upgrades are usually only one element of a larger building rehabilitation project, some respondents wanted to know how other multifamily building owners and managers made large-scale energy-efficiency improvements within larger capital improvements. One respondent would like to know the overall size of projects that incorporate energy-efficiency upgrades.
- **Process for including utilities in rent.** One respondent suggested these questions for further research: How do property owners fold utilities into the rent? What process do property owners and managers use to decide which utilities to include in the rent? Would the decision-making process and the implementation process for including utilities in the rent change, and if so why?

Findings and Conclusions

The findings and conclusions below focus on the most prevalent themes to emerge from our interviews with stakeholders.

1. ***Opportunities exist to increase ESA Program participation by engaging multifamily building owners and operators directly as a means to reaching more individual tenants.***

Interview respondents commonly stated that the ESA Program could increase participation by helping the multifamily building owners participate in the program for the benefit of their tenants. When owners act as a conduit to serving their tenants, then removing barriers to participation by building owners enhances program effectiveness by increasing overall program participation. Thus, through the program and through the building owner's participation, tenants are provided with lower energy bills and improved health, comfort, and safety.

Interview respondents expressed the desire to provide tenants with benefits offered by energy efficiency programs. However, respondents said concerns such as timing of upgrades, cost-effective measures, and limiting administrative time must remain a priority when considering participation in energy-efficiency programs. This suggests building owners' competing priorities can affect their willingness to provide permission for unit upgrades, thus hindering program participation by tenants.

2. ***Utilities can more effectively and efficiently serve multifamily customers—building owners and tenants—through a single point of contact to guide enrollment and participation in all available utility energy efficiency programs.***

The solution to increasing participation in the ESA Program mentioned most often by respondents, which seem to touch most all of the concerns raised by respondents, is the creation of a single point of contact for multifamily building owners, managers, and tenants. Ideally, this customer liaison would be knowledgeable about all programs—utility energy-efficiency programs, and, non-utility programs serving low-income populations—available to multifamily building owners and tenants. The contact

could help building owners determine the right programs for their property, how to leverage the programs, and the optimal timing and sequence for participating in the programs. This person (the single point of contact) could also guide building owners through the program's application process, which would cut down on costly administrative time spent sorting out the various program requirements.

Respondents reported financing for property upgrades affect participation in the ESA Program. Related to funding is the timing of major energy efficiency improvements with property recapitalization, which generally occurs in 15- to 20-year cycles for subsidized housing. Interview respondents did not provide a single specific solution, but suggested that a more flexible program could allow for layering of energy-efficiency retrofits along with other planned building rehabilitation projects. Again, this could be mitigated with assistance from a single point of contact with expertise in finance options.

3. ***Large-scale building upgrades and treatment of the whole building, including common area measures, may be the best way to achieve highest energy savings at lowest cost. However, this applies to large multifamily complexes and subsidized housing rather than smaller properties.***

Concern for obtaining cost-effective savings pervaded many of the interviews, either directly or indirectly. Interview respondents mentioned that in order to invest in energy-efficiency upgrades, costs to the property owners must be weighed against benefits—to both the owner and the tenants—in order to justify their implementation. This concern is related to receiving funding approval from investors, timing of upgrades with building financing cycles, the level and length of time for savings paybacks on measures, and administrative time invested in program applications and requirements.

Many respondents felt that if the ESA Program would allow treatment of the whole building, they could achieve maximum savings for their buildings at the lowest cost, whether through a single program or overlapping several programs (such as the ESA Program for units and the MFEER or EUC program for common areas). That is, by integrating or overlapping the ESA Program with other programs, multifamily building owners could upgrade the property as a whole rather than making small upgrades (or repairs and replacements) at different times.

Author's Note

It appears that the stakeholders' perceptions of the ESA Program do not always reflect the program's design and objectives. Respondents' comments indicate they may not be aware of or understand the reasons for differences in the IOU's programs or why the programs operate as they do.

However, consideration should be given to the limited scope and duration of the interviews. Because many of the questions concerned financing and investment structures, any perceived emphasis on funding may be disproportionate to the actual extent of the stakeholder concerns.

We acknowledge that this synthesis of stakeholder experiences and perceptions may not provide an accurate picture of their overall understanding of the program and program rules as implemented by

the IOUs. (Section 6 provides overview of the ESA Program and other multifamily programs in California.)

Section 5. Comparison Programs Across the Country

This chapter presents findings from Research Into Action's review of multifamily programs operating outside of California. The review sought to identify strategies that other programs have found to successfully reach the low-income multifamily market and included two primary tasks. The research team's first task was to catalog relevant multifamily programs operating throughout the United States. The team then selected a cohort for further investigation and more in-depth analysis.

This comparison research sought to identify program strategies in use around the country to reach the low-income multifamily market. A program's inclusion in this comparison does not imply a recommendation that the ESA program adopt that program's design. The research team recognizes that important differences exist in both the program goals and the markets served between the comparison programs and the ESA Program. These differences have the potential to influence measure costs and savings potential as well as the extent to which an approach would appeal to the multifamily market. In developing recommendations for the ESA Program, the research team has sought to consider the program design approaches described in this section in the context of the California program landscape, the goals of the ESA Program, and the characteristics of California's low-income multifamily sector.

Appendix H summarizes the eligible measures for California programs targeting the multifamily sector. The programs are discussed in Section 5 of this report.

Program Catalog Findings

The research team reviewed publically available information sources (including American Council for an Energy-Efficient Economy (ACEEE) reports, program filings, monthly and annual program reports, evaluation reports, and information on program websites) to identify 44 programs outside of California that focus on low-income households, multifamily households, or both. Upon further review, the team excluded seven of these programs after determining they were: duplicative, only tangentially relevant to multifamily properties, or focused only on new construction.[47] This left the research team with 37 programs pertinent to the research objectives.[48]

[47] As this study seeks to identify opportunities for the ESA Program to better serve the multifamily sector, and the ESA Program serves low-income ratepayers in their existing households, the research team's review excluded programs that focused on new construction.

[48] Multifamily buildings or residents are eligible to participate in many programs that do not specifically target the multifamily sector; appliance recycling programs are a common example. As this review sought to identify effective approaches to the multifamily sector specifically, the research team's review only included programs directly targeting multifamily buildings or residents.

As this study is focused on identifying program approaches to reach the low-income multifamily sector, the research team specifically sought to understand how each multifamily program approached low-income populations. That is, was the program designed to:

- Focus exclusively on the low-income sector?
- Serve a broader population, but have offerings specific to the low-income sector?
- Differentiate between the low-income sector and other sectors served?

Program Administration and Funding

While utilities administer the majority of programs identified (25 of 37), public benefit organizations and nonprofit groups more often administer the programs focusing on the low-income sector, as shown in Table 35. Utilities, however, administered all the low-income multifamily programs launched in 2013, potentially indicating a growing national interest among utility program administrators in reaching this segment. Among the multifamily programs that do not differentiate between low-income and standard buildings (standard offer programs most similar to MFEER), more than three-quarters are administered by utilities.

Table 35. Program Administrator Type

Administrator Type	Low-Income-Focused Programs		Non-Low-Income-Focused Programs	Total
	Established	New		
Utility	3	5	17	**25**
Non-utility Public Benefit Organization	4	0	2	**6**
Government	1	0	3	**4**
Nonprofit	2	0	0	**2**
Total	**10**	**5**	**22**	**37**

Consistent with the prevalence of utility program administrators, 84% (32 of 37) of the programs were identified as exclusively funded with ratepayer funds, and almost all receive at least some funding from ratepayers, as shown in Table 36. Only one program, administered by the Connecticut Department of Economic and Community Development, appears to operate exclusively on taxpayer funds.

Table 36. Funding Sources

Funding Source	Low-Income-Focused Programs		Non Low Income-Focused Programs	Total
	Established	New		
Ratepayer funds exclusively	6	5	21	**32**
Taxpayer and ratepayer funds	4	0	0	**4**
Taxpayer funds	0	0	1	**1**
Total	**10**	**5**	**22**	**37**

ELIGIBILITY CRITERIA

The identified multifamily programs most often define multifamily buildings as containing five or more units, as shown in Table 37.

Table 37. Definition of Multifamily Buildings

Minimum Number of Units	Count of Programs	Proportion of Programs
2	1	3%
3	6	16%
4	4	11%
5	17	46%
Not listed	9	24%
Total	**37**	**100%**

The 15 programs identified that specifically target the low-income sector vary in their income qualification criteria, as shown in Table 38. Programs most often base their income qualification criteria on a percentage of tenants in a building earning less than a set proportion of the area median income or the federal poverty level. Other income qualification criteria include state-level requirements (such as the Minnesota Low-Income Rental Classification).

Table 38. Income Qualification Criteria

Income Qualification Criteria	Number of Programs
Percentage of area median income	5
Percentage of federal poverty level	2
Public and subsidized housing only	2
Other	2
Income qualification not required	3
Not listed	1

Incentives

The majority of the cataloged multifamily programs identified offer prescriptive incentives[49], although direct installation of measures, such as faucet aerators, showerheads, water heater pipe wrap, and CFLs is also a common approach. Table 39 lists the number of programs offering incentives of each type (for example, prescriptive incentives, direct installation, custom incentives etc.). Nearly one-half of the programs identified (15 of 37) offer more than one type of incentives. Most often, these programs offer a combination of direct installation and measures with prescriptive incentives (8 of 15). For example, some programs offer direct installation of measures inside dwelling units, in conjunction with prescriptive rebates for common area lighting. Five programs also offer direct installation, prescriptive

[49] Prescriptive incentives are those that offer a set dollar amount per measure. A customer purchases the measure and receives a pre-set dollar amount from the utility designed to offset the incremental cost of the measure.

incentives, and custom incentives to subsidize different types of measures. Four programs do not directly provide incentives, with most of these focused on facilitating access to other incentive programs.

Table 39. Types of Incentives Offered[1, 2]

Incentive Type	Low-Income Focused Programs (n=15)		Non-Low-Income Focused Programs (n=22)		Total (n=37)	
	Number	Percent	Number	Percent	Number	Percent
Prescriptive	7	47%	13	59%	20	54%
Direct install	7	47%	10	45%	17	46%
Custom	7	47%	5	23%	12	32%
CFLs provided to building owner	0	0%	2	9%	2	5%
Program does not directly provide incentives	2	13%	2	9%	4	11%
Unclear	0	0%	2	9%	2	5%

1. Programs may offer multiple types of incentives
2. As suggested in Table 39, programs focused on low-income multifamily buildings are more likely to offer custom incentives[50] and less likely to offer prescriptive incentives than programs not focusing on the low-income market.

In-Depth Comparison Program Findings

None of the programs identified in the catalog excluded multifamily buildings serving low-income tenants. However, many programs did not include specific strategies or services to overcome the unique challenges of serving low-income multifamily buildings. The programs most relevant to this research—those with promising, comprehensive, multifamily segment strategies relevant to the ESA Program—provide offerings specific to both the low-income and multifamily sectors. Fifteen of the 37 programs reviewed focused exclusively on the low-income multifamily market or had unique program offerings for low-income buildings or their tenants, as shown in Table 40.

Table 40. Multifamily Program Approaches to Low-Income Sector

Approach to Low-Income Sector	Number of Programs
Exclusive focus	12
Specific program offerings	3
Do not differentiate	22

Of the 15 programs with activities that specifically targeted the low-income multifamily sector, five launched in 2013 and reported few (if any) results that the research team could examine to evaluate the

[50] Custom incentives are determined by a calculation of energy savings that result from installed measures. The participant does not receive a set dollar amount for installing a specific measure. Instead the participant receives an incentive based on the amount of energy savings or some other calculated method.

effectiveness of their approach. Five additional programs were excluded because they had small budgets, served populations with very few multifamily households, or because the program's status was unclear. The remaining programs appeared to be the most successful and best documented of the ten programs specifically targeting the low-income multifamily sector. All five of these programs target building owners and managers, rather than individual low-income tenants, and all support efficiency measures in common areas and central building systems, in addition to tenant dwelling units.

The research team then conducted an in-depth review of these five programs, expecting that they would yield the greatest insight into program approaches relevant to the ESA Program. The five programs chosen for comparison were selected because they served areas with large multifamily populations relative to the United States as a whole and because they represented a range of program approaches. Table 41 lists the five programs selected for in-depth review.

Table 41. Comparison Programs Selected for In-Depth Review

Program Administrator	Program Name	Area Served
CNT Energy	Energy Savers Multifamily Program	Chicago metropolitan area
Energy Outreach Colorado (EOC)	Low-Income Multifamily Weatherization Program	Colorado
Massachusetts Gas and Electric IOUs	LEAN[1] Multifamily Program	Massachusetts
NYSERDA[2]	Multifamily Performance Program (MPP)	New York State
Public Service Electric and Gas Company (PSE&G)	Residential Multifamily Housing Program	North-central New Jersey

1. Low-income Energy Affordability Network.
2. New York State Energy Research and Development Authority.

To understand each comparison program, the research team conducted a more detailed literature review and in-depth interviews with specific program managers. Drawing on the literature review and interviews, the research team prepared summaries describing each program's approach, and submitted these to the interviewed program managers, who reviewed them for accuracy.

This section provides a brief summary of each in-depth comparison program's approach to the low-income multifamily market, followed by a more in-depth comparison of program design, delivery, and accomplishments across the five programs.

Comparison Program Background

CNT Energy: Energy Savers Multifamily Program

The Energy Savers Multifamily Program seeks to provide Chicago area multifamily building owners with a "one-stop shop" to support energy-efficiency upgrades. The program analyzes a building's utility bills, and conducts an energy assessment[51] to identify potential energy-efficiency improvements. Program staffs are available to support building owners during the installation process, including developing bid proposals, reviewing bids, and monitoring work. The program does not offer incentives to buildings for completing retrofits. However, program staff shepherd owners through the participation process including assisting building owners in obtaining incentives from utility programs and other sources, and recommending financing options. Program staff emphasized that, in their role as the main contact for the building owner, they do not simply refer participants to incentive and financing programs. Instead, the staff assists with all technical and administrative work associated with participating in these programs, including filling out application forms and coordinating any necessary inspections.

The program partners with the nonprofit Community Investment Corporation (CIC), an organization providing mortgage financing to multifamily building owners to support neighborhood revitalization. With the support of a loan loss reserve fund that the City of Chicago provided using funding from the U.S. Department of Energy's Better Buildings Neighborhood Program, CIC offers loans at a 3% interest rate that participating building owners can use to pay for their energy upgrade projects. CIC does not receive utility ratepayer funding.

The Energy Savers Multifamily Program was created to preserve the availability of affordable rental housing, but the program does not require buildings to meet income qualifications to receive support. According to program staff, income-qualified buildings may access a wider range of incentive and financing programs such as the Illinois Department of Commerce and Economic Opportunity's low-income housing trust fund, LIHEAP, and the HUD Green Refinance Plus program.

Energy Outreach Colorado: Low-Income Multifamily Weatherization Program

The nonprofit Energy Outreach Colorado uses funding from federal weatherization programs, utility incentives, and other sources to address the efficiency needs of multifamily buildings, serving low-income residents, including measures in tenant units, common areas, and central systems, through its Low-Income Multifamily Weatherization Program. Ten percent of each funding source is reserved for staff and administrative costs.

Buildings must meet income qualification requirements to participate. The program uses a central application and assessment process for all participating building owners, regardless of the funding sources their projects use. This assessment is done via a site visit by EOC staff, with the goal of

[51] This assessment includes a building analysis and a thorough inspection of the building to identify the most cost-effective investments for the building. The assessment takes about 2 hours and includes a review of hot water heating equipment, basements, HVAC equipment, and about 10% of all units in the building.

determining whether sufficient energy-efficiency retrofit opportunities exist to justify a Department of Energy approved full-scale audit. These full-scale audits meet the demands of utilities and provide building modeling. EOC staff work with building owners to interpret the audit findings and develop a scope of work. EOC acts as a general contractor and manages the retrofit installation process. Installation contractors contract with both EOC and the building owners.

As the program's funding sources use varying incentive structures, the incentives the EOC offers may vary, based on the extent that a particular building draws on each funding source. EOC staff reported the program's incentives typically cover approximately one-half of the cost of an efficiency retrofit. EOC's Low-Income Multifamily Weatherization Program typically treats a smaller number of buildings on an annual basis than the other comparison programs.

Massachusetts Utility Program Administrators: Low-income Energy Affordability Network (LEAN) Multifamily Program

The Massachusetts efficiency program administrators—the state's gas and electric investor-owned utilities—contract with two lead agencies, Action for Boston Community Development (ABCD) and Action, Inc., to administer the LEAN multifamily program.

The program acts as a single point of contact for multifamily building owners interested in energy upgrades, leveraging existing utility energy-efficiency offerings, focused on lighting and appliances, in addition to program-provided weatherization services and support for central system upgrades.

Program staff assists building owners in benchmarking their energy use, conducting assessments,[52] and developing a scope of work. The program also selects contractors to conduct installation work, although building owners can use their own contractors as long as those contractors agree to the program's pricing. The program subsidizes the full cost of efficiency retrofits that meet cost-effectiveness requirements.[53] Buildings must meet income-qualification requirements to participate in the LEAN Multifamily Program.

NYSERDA: Multifamily Performance Program

NYSERDA's Multifamily Performance Program (MPP) offers incentives to building owners, based on the number of units in a building, to achieve a minimum 15% reduction in energy use. Buildings achieving a 20% or greater reduction in energy use receive bonus incentives, based on measured energy savings. All multifamily buildings may participate in the MPP, but the program offers higher incentives to buildings serving low-income tenants.

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[52] In some cases the assessments will be comprehensive audits that examine the building envelope, mechanical systems and motors, ventilation, lighting, etc. Where opportunities exist to combine cost effective energy-efficiency work with building renovations, the assessments will likely be more limited in scope.

[53] Measures must have a TRC value for gas greater than 1.8 and for electric greater than 2.1. Additional details on cost-effectiveness are in Measures Installed section of report.

Participating consulting engineers, which NYSERDA refers to as "Partners," deliver the MPP. Partners recruit participants, who contract directly with the Partner to complete their project. Partners work with building owners to benchmark a building's energy performance, conduct the building audit, and identify cost-effective efficiency opportunities. Partners also work with building owners to develop a scope of work for the upgrade project and to identify financing sources the building owner can use to pay for the project. The Partner creates an Energy Reduction Plan, articulating the scope of work and the financing sources. Partners support building owners through the installation process, ensuring correct installation of measures. Finally, Partners determine that all measures are installed and functional to the intent of the Energy Reduction Plan and Partners schedule a time with the MPP Program to complete their site inspection. In addition the Partner completes a post retrofit utility bill analysis one year after project completion. If the Partner determines that the building achieved energy savings of at least 20%, the building owner receives an additional performance incentive.

Public Service Electric and Gas (PSE&G): Residential Multifamily Housing Program

Like NYSERDA's MPP, PSE&G's Residential Multifamily Housing Program draws on consulting engineers to guide participants through the retrofit process. However, while building owners contract with the MPP's Partners directly, the consulting engineers delivering the Residential Multifamily Housing Program work under contract to PSE&G. Despite this distinction, the two programs use similar participation processes. In PSE&G's program, the program's consulting engineers conduct audits,[54] identify retrofit opportunities, work with building owners to develop a scope of work and select installation contractors, and monitor the quality of the installation work. The scope of work is based on the financial constraints of the owner and what projects within the buildings will save the most energy.

The Residential Multifamily Housing Program bases its incentives on the simple payback of the efficiency measures identified. Any measure with a simple payback of 15 years or less is eligible. Incentives are set by reducing the simple payback of all measures by seven years (with a cap to keep simple payback to at least two years). The program offers on-bill repayment at zero percent interest for the balance of the retrofit costs.

PSE&G designed the Residential Multifamily Housing Program in partnership with the New Jersey Housing and Mortgage Finance Agency (NJHMFA). A state agency, NJHMFA focuses on increasing the availability of affordable housing, and offers programs for single-family homebuyers as well as owners of affordable multifamily housing. NJHMFA has played a role in identifying and recruiting buildings to participate in the Residential Multifamily Housing Program; in the program's first funding cycle (2009 and 2010) all participants were low-income properties identified by NJHMFA. Although the Residential Multifamily Housing Program was designed to meet the needs of the low-income multifamily buildings NJHMFA serves, the program later opened participation to all multifamily buildings.

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[54] The depth of the audit is determined by the consulting engineers. A walk through is done initially that determines if a deeper audit is necessary.

Program Context

Regulatory Context

All five programs selected for in-depth reviews formed or were substantially redesigned within the last five years,[55] suggesting that multifamily low-income programs are evolving across the country. Three of the programs formed in response to legislation establishing energy-efficiency resource standards. The administrators of two of these programs—EOC in Colorado and ABCD and Action, Inc., in Massachusetts—advocated for inclusion of low-income programs in energy-efficiency offerings designed to meet new resource standards prior to receiving funding to implement their programs.

While the comparison programs typically benefitted from increased funding for energy efficiency resulting from establishment of energy-efficiency resource standards within their jurisdictions, the regulatory context in which they operate also posed challenges for some comparison programs.

For example, one primary challenge LEAN Multifamily Program staff reported resulted from the structure of Massachusetts' energy-efficiency funding mechanism. Massachusetts' ratepayer funding for electric-efficiency measures is tracked separately from ratepayer funding for gas-efficiency measures. Consequently, the LEAN Multifamily Program cannot transfer funds between its budgets for electric efficiency and gas efficiency. Staff stated the program received sufficient funding to provide the cost-effective electric-efficiency measures identified in all of the participating buildings, but not sufficient to install all of the gas-efficiency measures identified as cost effective. This discrepancy can mean that the program is able to address electrical efficiency opportunities, but must wait to address gas-efficiency measures until funding becomes available in the gas-efficiency budget—potentially years later.

Program Administration

The organizations selected for an in-depth review reflect the prevalence of nonprofits and public benefit administrators in established low-income multifamily programs. Utilities administered only two of the five programs: the LEAN Multifamily Program in Massachusetts, and PSE&G's Residential Multifamily Housing Program in New Jersey-- the PSE&G program is the only comparison program directly administered by a utility. Nonprofit organizations (EOC, CNT Energy, and the Massachusetts program implementers, ABCD and Action, Inc.) and a non-utility public benefit program administrator (NYSERDA) implemented the remaining programs.

The nonprofit organizations administering and implementing the comparison programs also implement a variety of efficiency programs in addition to the multifamily offerings, typically targeting low-income residential customers and nonresidential facilities owned by non-profit organizations. Table 42 summarizes these program offerings.

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[55] NYSERDA's MPP existed prior to 2010. However, significant changes in the program design resulted because the program was required to have each measure installed meet the TRC. (The previous program required projects to meet the TRC at the project level.) These changes resulted in the program's suspension from June 2009 to October 2010.

Table 42. Nonprofit Organization Efficiency Program Offerings In Addition to Multifamily

Program Location	Organization	Efficiency Program Offerings in Addition to Multifamily		
		Low-Income Single-Family	Small Multifamily (2-4 Units)	Facilities Owned By Nonprofits
Massachusetts	ABCD, Action, Inc.	✓	✓	
Chicago	CNT Energy		✓	✓
Colorado	Energy Outreach Colorado	✓		✓

The nonprofit organizations implementing the comparison programs in Chicago, Colorado, and Massachusetts are not exclusively focused on delivering energy-efficiency programs. As community action agencies, the organizations implementing the LEAN Multifamily program in Massachusetts, ABCD, and Action, Inc., deliver other income-qualified programs such as Head Start. EOC administers utility bill assistance programs in addition to its efficiency work. CNT Energy administers dynamic energy pricing programs, and works with counties and municipalities to include energy efficiency as a consideration in urban planning.

Funding Sources

All of the in-depth comparison programs receive funding from utility ratepayers, although EOC, CNT Energy, and NYSERDA draw on additional funding sources to support their low-income multifamily programs.

Table 43. Funding Sources for Comparison Programs

Program Location	Implementer	Ratepayer Funds	Federal Weatherization Funds*	Other Gov't Funds**	Other Funding Sources
Chicago	CNT Energy	✓		✓	✓
Colorado	EOC	✓	✓	✓	✓
Massachusetts	LEAN	✓			
New Jersey	PSE&G	✓			
New York	NYSERDA	✓			✓

* Such as WAP and LIHAP
** Such as ARRA

Precise data on the proportion of each program's budget funded through each source were not available, although the information available about each program provides some sense of the extent to which each program draws on its various funding sources. Specifically,

- EOC staff reported that early in its implementation, their program primarily drew on federal weatherization funds, but currently ratepayer funding makes up approximately 60% of program funding, with federal weatherization funds contributing approximately 20% and other sources the remaining 20%.

- The Illinois Department of Commerce and Economic Opportunity granted CNT Energy a total of $2.9 million in ratepayer funding to deliver its low-income multifamily program over grant periods from January 2012 to June 2013.[56] The program spent a total of $5.3 million in 2012, which includes additional funding provided directly by natural gas utilities.
- Ratepayer funds provided through New York's Energy Efficiency Portfolio Standard account for 90% of the funding allocated to NYSERDA's MPP, with the remaining 10% of funding divided approximately evenly between Regional Greenhouse Gas Initiative (RGGI) and Green Jobs Green New York funding.

EOC's program and NYSERDA's program provide examples of programs bringing together multiple funding sources to support a single program delivery model. In each case, the various funding sources seek slightly different goals and place differing restrictions on use of the funds. Table 44 summarizes each program's funding source and its associated goals and restrictions. Data on the proportion of each program's budget that each funding source provides were not available.

Table 44. Energy Outreach Colorado and NYSERDA Funding Sources

Funding Source	Funder Goals	Restrictions on Use of Funds
EOC		
Utilities	Energy and demand savings.	Program must achieve a TRC value >1, including a 25% adder for non-energy benefits.
Federal weatherization funds	Maintenance and improvement of affordable housing.	Each measure must meet a savings to investment ratio >1.
City of Denver	Maintenance of affordable housing, energy savings, carbon reduction, water savings.	None identified.
Private donations	Broad support of EOC mission.	Unrestricted, but typically used only for cost effective measures.
NYSERDA		
Energy-Efficiency Portfolio Standard (EEPS): ratepayer funding	Energy savings contributing to a statewide 15% reduction in energy use by 2015.	Measures must have a TRC of 1.0 or greater. Advanced measures (e.g. photovoltaic) are not eligible.
Regional Greenhouse Gas Initiative (RGGI): proceeds from CO_2 allowance auctions	Reduce greenhouse gas emissions, energy savings.	Funds may only be used to support energy savings from heating fuels other than electricity or natural gas.

[56] Under Illinois' energy-efficiency portfolio standard, energy efficiency programs are funded through cost recovery tariffs. Utilities administer 75% of the funds, and the Illinois Department of Commerce and Economic Opportunity (DCEO) administers 25% of the funds. The DCEO distributes funds as contracts, grants, and rebates to municipalities and organizations in support of programs targeting low-income populations, government facilities, and information and training efforts to bring about market transformation.

Green Jobs Green New York (GJGNY): RGGI Funding	Energy savings, carbon reduction, job creation.	Can provide no more than one-half the funding for loans to support energy-efficiency projects.

By leveraging multiple funding sources, NYSERDA and EOC can address a greater range of participants' efficiency needs than a single funding source would allow.

For example, NYSERDA uses RGGI funds to replace space heating and domestic hot water systems, install building shell upgrades, and support other retrofits not covered under EEPS. GJGNY funds allow NYSERDA to offer low-interest loans to multifamily building owners for energy-efficiency upgrades and to support the program-required multifamily audits.

EOC first screens participants' eligibility to receive federal weatherization funds, then considers the performance-based incentives the building could receive from its utilities. EOC uses available funding from the City of Denver and private donations to support installation of cost-effective measures not eligible for federal or utility incentives.

While the programs in Massachusetts and New Jersey do not receive significant funding support beyond ratepayer dollars, both programs maintain relationships with government organizations or other groups providing administrative support. In Massachusetts, LEAN program staff described frequently working with local governments and redevelopment authorities to include efficiency measures in multifamily building retrofits these groups contribute funds to. Staff also reported working with a contact at the state housing authority to spread awareness of the program and to prioritize projects within the housing authority's network. In New Jersey, PSE&G works with the NJHMFA, which has helped publicize the program and recruit participants among its network of multifamily buildings.

Characteristics of Markets Served

Each in-depth comparison program operates in a multifamily market with unique characteristics. This section presents data drawn from the U.S. Census Bureau's American Community Survey (ACS) five-year estimates for 2007–2011 to compare the characteristics of the multifamily market across comparison program areas.[57]

[57] Figures listed for the PSE&G territory are estimates and include all of the counties PSE&G serves, although in some cases PSE&G territory does not encompass the entire county. PSE&G figures include the following counties: Bergen, Burlington, Camden, Essex, Gloucester, Hudson, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, and Union.

In terms of the absolute number of households living in multifamily buildings, the multifamily market as a whole, as well as the low-income multifamily market, in New York State is much larger than the multifamily markets the other comparison programs serve, as shown in Table 45.[58]

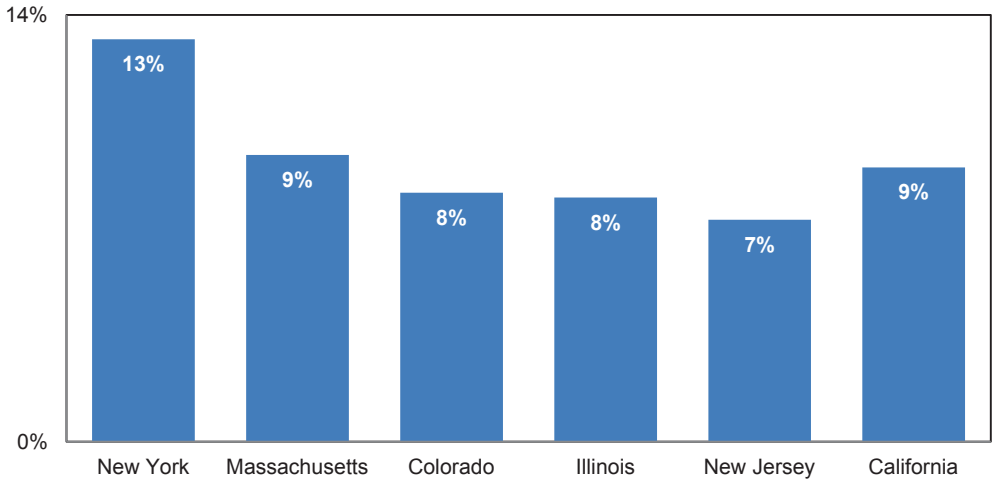
Table 45. Size of Multifamily Markets Served

State*	Households in Multifamily Buildings	Low-income Households in Multifamily Buildings	Proportion of Low-Income Multifamily Households
New York	2,631,249	989,225	38%
New Jersey	715,101	241,997	34%
Illinois	1,070,265	394,817	37%
Massachusetts	582,601	235,079	40%
Colorado	458,254	174,533	38%
California	2,798,336	1,175,301	42%

* Due to limited evaluation resources to conduct a more granular analysis, the data presented in this table are at the state level, although some comparison programs (notably CNT in Illinois and PSE&G in New Jersey) do not serve their entire state.

Low-income multifamily households also compose a larger proportion of New York State's housing stock than in the other comparison program areas. Approximately 13% of the households in New York State are low-income and live in multifamily buildings of five units or more. Massachusetts has the next highest concentration of low-income multifamily housing, with 9% of all households qualifying as low-income and living in multifamily buildings. Approximately 8% of all households in Colorado, Massachusetts, and New Jersey are low-income multifamily, as shown in Figure 48.

Figure 48. Low-income Multifamily as a Proportion of All Households



[58] For the purpose of these comparisons, multifamily buildings are defined as those containing five units or more.

The rest of this section reviews additional characteristics of the multifamily markets the comparison programs serve. However, data focused specifically on the low-income multifamily sector are not readily available, and, due to limited study resources, the research team was not able to examine these characteristics for low-income multifamily buildings specifically in each comparison program area. As a result, the findings presented below reflect all multifamily buildings in the comparison program territories, including those serving both low-income and non-low-income tenants. The low-income multifamily market may differ from the market as a whole in some of the characteristics listed below.

While CNT Energy's program operates entirely within the metropolitan Chicago area, the other comparison programs serve a more varied territory. In each case, however, the service territory's largest metropolitan areas contain the majority of multifamily housing, as shown in Table 46. This contrasts with California, which is larger than the comparison program areas and contains multiple large metropolitan areas.

Table 46. Proportion of Total Multifamily Units in the Largest Metropolitan Areas

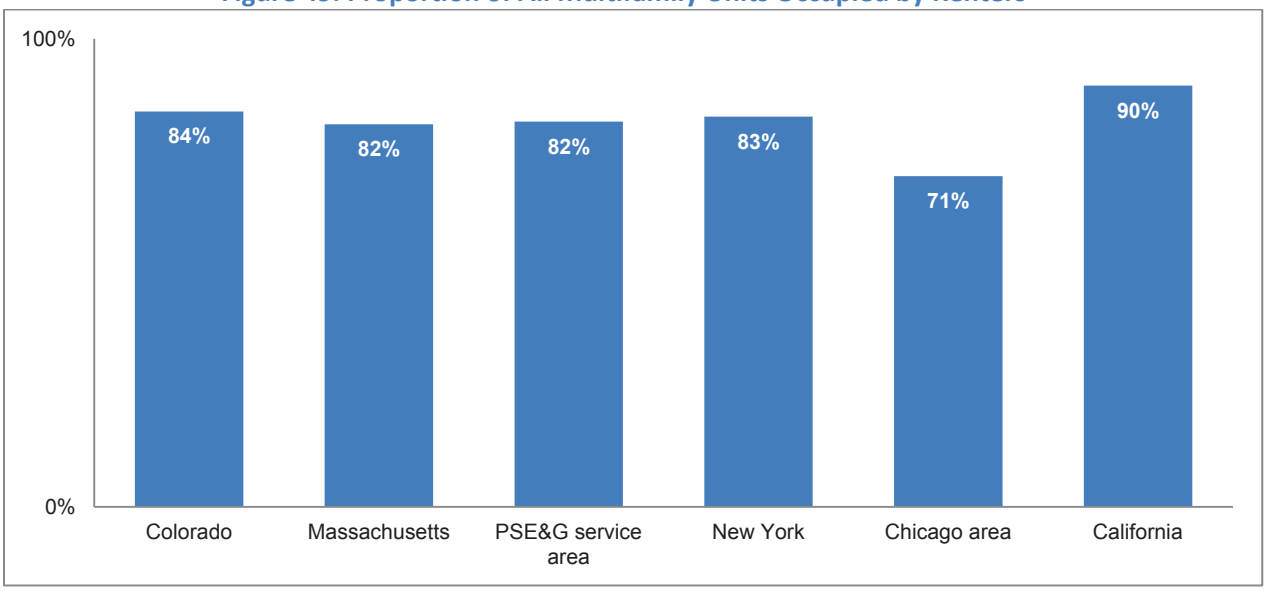
Program Area	Largest Metropolitan Area	Proportion of Multifamily Units
New York	New York City	87%
Massachusetts	Boston	73%
Colorado	Denver	67%
PSE&G service area	Newark*	61%
California	Los Angeles	47%

* Newark is part of the New York City Metropolitan Statistical Area (MSA). The figures listed reflect only the portions of the New York City MSA in New Jersey.

Although NYSERDA's program serves the entire state of New York, of the comparison programs, it contains the greatest concentration of multifamily units within its territory's largest metropolitan area. PSE&G's service area has the lowest concentration of multifamily units in its largest metropolitan area—the portion of the New York City metropolitan area in New Jersey. However, PSE&G's territory also includes portions of the Philadelphia metropolitan area, which Table 46 does not include.

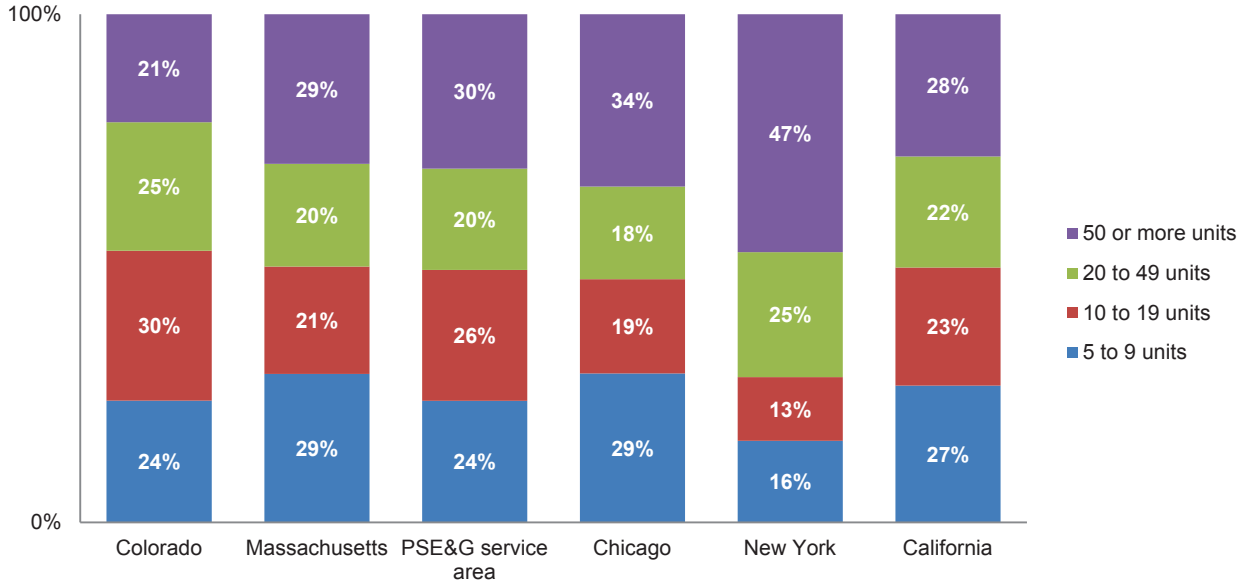
Renters occupy the majority of multifamily households in all comparison program areas, although the Chicago area has a higher proportion of owner-occupied multifamily units than the other comparison program areas, as shown in Figure 49. In all comparison program areas, a higher concentration of owner-occupied multifamily units occurs within metropolitan areas than in the service territory as a whole. Notably, however, these figures represent all multifamily households; the proportion of low-income multifamily residents who rent may not match that of the overall population. For example, in California renters occupy 90% multifamily units overall, but 96% of all low-income multifamily households are renters.

Figure 49. Proportion of All Multifamily Units Occupied by Renters



Large multifamily buildings are more prevalent in New York, Chicago, and New Jersey than in Colorado and Massachusetts, as shown in Figure 50. In New York, Chicago, and New Jersey a majority of multifamily units are located in buildings with 20 units or more, with 47% of the multifamily units in New York in buildings containing 50 units or more. As discussed in Section 3 (Figure 6), the size of multifamily buildings varies in different cities within California, with larger buildings accounting for a greater proportion of the units in the larger cities.

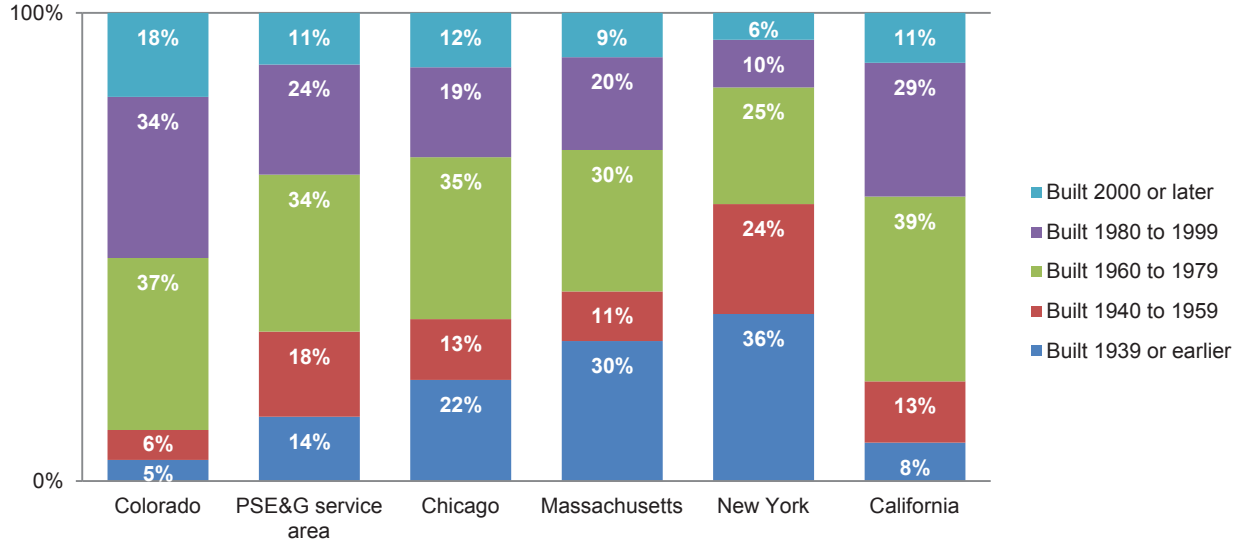
Figure 50. Proportion of Multifamily Units by Building Size



New York and Massachusetts exhibit a greater proportion of older multifamily buildings than the other comparison program areas, as shown in Figure 51. However, in all comparison program areas except

New York, a plurality of multifamily units is located in buildings built between 1960 and 1979. Again, it is important to note that these figures include all multifamily households – adequate income as well as low-income. Based on California data, low-income households may be more likely to live in older buildings. While Figure 51, below, indicates that 60% of all multifamily households in California live in buildings built prior to 1980, Figure 7 in Section 3 indicates that 68% of low-income multifamily households in California live in buildings built prior to 1980.

Figure 51. Proportion of Multifamily Units by Building Vintage



Program Theory and Goals

All five of the programs receiving in-depth reviews seek to generate energy savings as their primary goal. Program staff also noted that by reducing operating costs for multifamily buildings serving low-income tenants, their programs help property owners continue to provide affordable and comfortable housing.

To generate energy savings, the designs of multifamily programs examined sought to achieve two broad objectives:

- To overcome barriers to efficiency in the multifamily sector
- To increase the market for efficiency in multifamily buildings

This section lists barriers the comparison programs seek to address, market support objectives they seek to achieve, and briefly describes program approaches for each. The following sections provide additional detail on program activities and offerings.

Overcoming Barriers

The comparison programs examined seek to address three common barriers to efficiency in multifamily buildings:

- **Split incentives:** In many buildings, tenants pay the bills for energy used in dwelling units, and would thus benefit from energy savings. However, building owners are responsible for the costs associated with maintaining, replacing, and upgrading energy-using equipment. The effect of this barrier can prevent owners from making investments when the economic benefits accrue only to their tenants. It can also prevent tenants from making investments of time and money to secure upgrades for space they do not own.
- **A lack of awareness of efficiency among building owners and managers:** Building owners and managers may not be aware of opportunities available to improve the efficiency of their buildings or the potential energy savings available from various retrofit options.
- **A lack of access to capital for building owners:** Multifamily buildings, particularly those serving low-income tenants, often have tight operating margins and complicated financing structures, which can make it difficult for building owners to bear the upfront cost of energy upgrades.

Specifics about each program's approach to each barrier are provided thematically below.

Split Incentives

The strength of the split incentive barrier varies between comparison programs. While program services can benefit tenants as well as owners, all of the comparison programs focus on reaching building owners, meaning that the metering and subsidy status of the building affects the viability of projects. The Colorado Energy Office wanted to focus statewide multifamily efficiency efforts on master metered buildings, leaving local weatherization agencies to deliver services to units in individually metered buildings. Since building owners pay all energy costs for these buildings, EOC has largely avoided the split-incentive issue.[59] Among the other programs, reluctance on the part of building owners to invest in reducing tenant energy use is a more powerful barrier, addressed with an array of strategies:

- **Provide generous incentives.** The LEAN program in Massachusetts addresses split incentives by fully subsidizing retrofits, thus eliminating costs to the building owner.
- **Promote non-energy benefits.** CNT Energy promotes the non-energy benefits associated with energy-efficiency upgrades, such as reduced maintenance costs and lower tenant turnover. CNT Energy staff work to quantify these benefits.
- **Target public or subsidized buildings**. Contacts reported that split incentives are more easily overcome in public housing and multifamily buildings owned by nonprofit organizations. Staff from EOC and LEAN reported that all or almost all their participants are either publically subsidized buildings or nonprofits offering reduced rents to low-income people. For these types of buildings, efficiency retrofits align with non-profit organizations' missions to benefit the populations they serve. These organizations also often plan to own their properties longer than for-profit building owners.

[59] EOC is starting to work with more individually metered buildings and has completed many "low-cost measures" in these types of buildings.

- **Capture other tenant benefits.** Programs targeting the low-income multifamily sector often seek to ensure that any incentives provided to building owners to upgrade their buildings ultimately benefit the low-income tenants these programs seek to serve. To this end, EOC and the LEAN multifamily program require building owners to commit to not raising rents within a specified time period. In addition, EOC requires building owners to specify in their applications how they will use energy cost savings to benefit tenants. For example, building owners have pledged to provide increased case management in HUD-subsidized properties, to install playground equipment, and, in one case, to decrease rents.

  To monitor property owners' compliance with their agreements not to raise rents, EOC informs tenants of their landlord's agreement as part of their energy education. EOC staff also follow-up with building owners after tracking the building's energy use for 12 months following the retrofit, and during that meeting, EOC staff inquire about how the building owner is using their energy cost savings. EOC does not have authority to impose punitive measures on building owners that increase rents and or fail to use cost savings in a way that benefits tenants. However, a building owner who failed to comply with their agreements would be ineligible to participate in EOC programs in the future, which EOC staff noted could be a disadvantage for owners who have multiple buildings, as most of the program's participants do. EOC also asks that building owners return the funds the program has provided toward their retrofits if they sell a building that has received retrofits to a new owner who will not maintain the building as affordable housing.

Lack of Awareness of Efficiency among Multifamily Owners

Comparison program managers described efforts to educate multifamily building owners and managers about energy efficiency and their buildings' energy use through interactions during the retrofit process. EOC, the LEAN multifamily program in Massachusetts, and CNT Energy's program in Chicago use the energy assessment process to educate building owners and managers about their buildings' energy use and about opportunities to save energy in on-going operations and maintenance. Interviewees suggested that the education provided during the assessment process was informal as opposed to part of a curriculum. LEAN also encourages building owners and managers to participate in the post-installation inspection, ensuring they achieve a strong understanding of the efficiency improvements made through the program. During the inspection, owners and facility staff learn about the best ways to run their property efficiently. LEAN program staff reported two of the engineering firms the program works with have a great deal of experience working with facility managers, and have helped the program effectively communicate with these groups.

Building owner and manager participants in EOC's program must agree to participate in training on energy-efficiency opportunities, and EOC has contracted with other agencies to develop and administer more formal educational programs for these groups. EOC staff reported that, in at least one property, the program's education process motivated participants to make changes that generated substantial energy savings. EOC staff works with owners and property managers on a one-on-one basis to get them

to understand how important behavior is to saving energy. EOC has held meetings with various project staff members, post installation, to share best practices with facility managers and provide them an opportunity to ask questions about ways to save energy. EOC also created a formal resident training program that facility staff delivers to residents.

Lack of Access to Capital

As described in greater detail below, to overcome barriers regarding access to capital, all comparison programs, except for CNT Energy's program in Chicago, provide incentives designed to cover a large proportion of retrofit costs. Managers of the LEAN Multifamily Program in Massachusetts, which was designed to cover all of the costs associated with participants' energy savings upgrades, stated these large incentives allowed the program to avoid the considerable effort required to work with building owners to develop financing packages for their projects.

In addition to incentives, three comparison programs (PSE&G, NYSERDA's MPP, and CNT Energy) offer building owners financing to cover the cost of efficiency retrofits.

- In New Jersey, PSE&G offers opportunities for participants to repay the balance of their upgrade costs in installments as a line-item on their utility bills. Offering on-bill repayment in this way may allow building owners to access financing for retrofit projects without obtaining approval from their investors, as they typically must do before a building takes on additional debt.
- NYSERDA's MPP and CNT Energy's program in Chicago do not offer on-bill repayment, although both programs work with building owners to identify financing options, including (but not limited to) loans offered by the program or its partners.

Increasing the Market for Energy Efficiency

All five programs included activities expected to influence building owners and managers to make energy efficiency a regular consideration in their decision-making processes and develop a base of contractors and engineers capable of delivering energy-efficiency services to multifamily buildings.

Influencing Building Owners

Several comparison programs seek to incorporate energy efficiency into multifamily building owners' and managers' day-to-day business practices. Illustrating the need for such a shift in awareness of building energy use, EOC staff reported that building owners frequently continue to repair old, inefficient equipment rather than replace it and typically select the lowest-cost option without regard for efficiency when replacing equipment. Thus, the program seeks to work with building owners, managers, and tenants to build their understanding of efficiency, and ensure they know of—and have bought into—the efficiency improvements installed through the program.

The LEAN multifamily program in Massachusetts encourages building owners and managers to take part in building audits to better their understanding of their building's energy use and savings opportunities.

The program also provides participants with analyses from energy benchmarking software,[60] which allows them to monitor their buildings' energy use, in addition to helping the program prioritize applications and track savings.

To encourage program participants to remain engaged with their energy use and to continue to operate their buildings efficiently, CNT Energy sends past participants annual billing analysis reports that estimate the energy and cost savings resulting from their retrofits.

The structure of the incentives NYSERDA offers through the MPP may also encourage building owners to consider energy use in their decision making and take actions to reduce energy use. The performance incentives offered for buildings exceeding a 20% reduction in energy use draw upon an analysis of consumption data for 12 months following installation. Building owners that do not meet the performance targets anticipated in their Energy Reduction Plans receive incentives commensurate with their buildings' actual energy performance.[61] Thus, building owners who do not prioritize operations and maintenance practices may receive a lower-than-expected incentive.

Developing a Base of Contractors and Engineers

Managers of two of the comparison programs—NYSERDA's MPP and the LEAN multifamily program in Massachusetts—described efforts to build a base of contractors and engineers with specific expertise in specifying and installing efficiency measures in multifamily buildings.

NYSERDA offers training to the consulting engineers that deliver the MPP and verifies their credentials prior to approving them for participation. In training these Partners, NYSERDA provides technical information about installing efficient equipment in multifamily buildings and information about resources available to help finance comprehensive energy-saving projects. Through these efforts, NYSERDA seeks to build a group of professionals uniquely qualified to conduct multifamily energy-efficiency work. NYSERDA also hopes this group of professionals will apply their efficiency knowledge to their work outside the program, both in multifamily buildings and in other commercial facilities.

Program staff in Massachusetts reported their program has faced a shortage of contractors capable of completing weatherization work on the scale necessary to treat multifamily buildings. Staff noted that small contractors may not have the logistical and administrative capabilities to complete large, multifamily weatherization jobs. As a result, the program works to expand the market. Building on the experience of ARRA-funded contractor training programs, the LEAN multifamily program encourages experienced weatherization contractors to expand into the multifamily market.

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60 The LEAN Multifamily Program provides participants with WegoWise, privately developed benchmarking software that is available to the general public.

61 Owners of buildings that exceed their performance targets receive bonus incentives that reflect their predicted savings; they do not qualify for larger incentives.

Program Activities and Offerings

Eligibility Requirements

PSE&G's and CNT Energy's programs target low-income buildings, but do not require income qualification. NJHMFA only provides financing to buildings offering rents accessible to low-income households. As a result, all participants coming to PSE&G's Residential Multifamily Housing Program through its partnership with the NJHMFA serve low-income populations.

Similarly, many of CNT Energy's participants come to the program as referrals from Chicago's Community Investment Corporation (CIC)), which primarily works with buildings serving low-income populations. CIC is a not-for-profit mortgage lender that provides financing to buy and rehabilitate multifamily buildings in the Chicago area.

The three comparison programs requiring income verification each specify different income-eligibility criteria, as shown in Table 47. NYSERDA uses the most inclusive income-eligibility requirements, allowing tenants to earn a larger proportion of the state median income than the LEAN Multifamily Program in Massachusetts, and requiring a lower proportion of tenants meet the income requirements than the other two programs.

Table 47. Income Eligibility Requirements

Administrator	Program Name	Income Eligibility Requirement	Proportion of Tenants Who Must Meet Eligibility Requirement
EOC	Low-income Multifamily Weatherization Program	200% of federal poverty level or less	67%
Massachusetts IOUs	LEAN Multifamily Program	60% of area median income or less	50%
NYSERDA	MPP	80% of state median income or less	25%

Verification

The three comparison programs requiring income verification accept participation in state or federal low-income housing programs as verification that a building meets their income requirements. As many of the buildings these programs serve receive subsidies from state or federal low-income programs, income verification typically does not pose a major challenge.

For example, EOC staff review HUD applications of public and assisted multifamily properties, and LEAN program staff review the income certifications that building owners receiving state or federal subsidies are required to conduct on an annual basis.

For the EOC, LEAN, and NYSERDA programs, buildings not receiving federal subsidies qualify to participate, but the process of verifying income eligibility becomes more involved. In such cases, EOC's program collects data on every tenant. In the process of collecting this information, the program asks

tenants to sign a release providing access to their utility billing data, and acknowledging that retrofit work will take place in the building. The program also gathers information on tenants' chemical sensitivities that may be relevant in the process of installing upgrades.

The LEAN and NYSERDA programs leave responsibility for providing income verification data to the building owner. In NYSERDA's program, building owners can use the building's "rent roll" as a proxy for tenant income. Through this method, building owners calculate tenants' annual household income based on rent and occupancy, assuming housing costs make up 30% of household incomes. Building owners also can qualify by submitting signed income certification forms and supporting documentation for 25% of the units in a building.

None of the comparison programs have significant staff capability to conduct door-to-door income verification, a factor likely contributing to the prevalence of public and subsidized housing among these programs' participants. Contacts at EOC and LEAN reported that the large majority of the for-profit building owners that participate in their programs receive some type of subsidy to support affordable housing, and the buildings referred to PSE&G's program through the NJHMFA are largely subsidized. CNT Energy staff reported that many of the buildings that participate in their program are not subsidized, although the program does not require buildings owners to provide income verification documents. Data on the proportion of the affordable properties NYSERDA serves through its MPP that receive subsidies were not available.

Prioritization

Three of the five comparison programs (EOC, LEAN, and PSE&G) receive more applications from interested building owners than their budgets allow them to serve. As a result, these programs have developed criteria by which to prioritize projects.

LEAN requires applicants to use program-provided benchmarking software, called WegoWise. Applicants enter one year of energy-usage data as well as characteristics of their buildings into the benchmarking tool. The software provides a score, based on the energy intensity and energy-savings potential of the building, which the program uses to prioritize applications. Program staff stated, however, that they also may prioritize buildings with planned equipment replacement or renovations that would time nicely with an efficiency retrofit. For example, building owners may take advantage of previously planned renovations to complete efficiency upgrades they would be unlikely to complete as stand-alone projects, like boiler replacements or adding insulation. By not acting at the time of the renovation, the program may lose the opportunity to make these efficiency improvements.

EOC is the only comparison program that does not accept applications on an ongoing basis. Instead, EOC accepts applications during defined application periods, based on its funding availability. Similar to the LEAN program, EOC considers the energy-savings potential of applicants' buildings in prioritizing projects, and seeks to ensure the buildings it treats are balanced between urban and rural areas and are geographically distributed throughout the state.

PSE&G distributes its program funding on a first-come, first-served basis.

Outreach

EOC's program in Colorado, the LEAN program in Massachusetts, and PSE&G's program in New Jersey reported reaching out to organizations already working with low-income multifamily properties to promote their services. Local community action agencies promote the LEAN program in Massachusetts. In Colorado, EOC initially conducted outreach through statewide affordable housing associations, and, more recently, has started reaching out to apartment manager associations to more effectively contact market-rate building owners. In New Jersey, PSE&G leveraged NJHMFA's relationships with multifamily building owners to generate leads. PSE&G's consulting engineers also bring leads to the program.

NYSERDA's program delivery model (described in greater detail below) draws upon the services of program Partners, engineering and construction firms that guide participants through the retrofit process. These Partners take the primary responsibility for promoting the program to building owners.

CNT Energy staff reported that, in addition to its standard outreach efforts (such as attending community events and speaking at trade shows), its partner lending agency, CIC, refers many participants to the program. Contractors and past participants also provide referrals. Additionally, the Chicago Housing Authority provides possible leads to CNT Energy.

Program Delivery Roles

All of the in-depth comparison programs act in five key areas to achieve efficiency retrofits in low-income multifamily buildings:

- Supporting building owners through the retrofit process
- Assessing energy-savings opportunities and developing a retrofit scope of work
- Assisting with financing
- Installing energy-efficiency measures
- Ensuring the quality of installations and verifying energy savings

The five comparison programs draw on distinct combinations of implementation staff, installers, and engineers to fulfill each role. While each program has multiple people working on a project, one similarity across all five programs is the single point of contact interface between the program and the participant. The following sections describe the approaches of each comparison program.

Participant Support

Conducting retrofit work in multifamily buildings is a complex undertaking that requires identifying efficiency opportunities and defining a scope of work for efficiency retrofits that requires specialized, technical knowledge. Consequently, all the comparison programs use established systems to help participating building owners and managers identify retrofits and guide them through the retrofit process. The following sections describe greater detail on the comparison programs' approaches to each step in the participation process. However, all five comparison programs provide participant support at each stage, including the following:[62]

- Using historical utility billing data to analyze the energy use of applicants' buildings. Some comparison programs, such as the LEAN multifamily program, help building owners enter their data into benchmarking software,[63] which the building owners can continue to use to monitor their energy use after the retrofit.
- Conducting assessments or audits to identify energy-savings opportunities and helping building owners to interpret the results. All the comparison programs provide assessments or audits to building owners at no cost. The comparison programs also work with building owners to develop a retrofit scope of work that meets both the participants' needs and program cost-effectiveness requirements.
- Identifying the incentive and financing options building owners can use to fund their retrofits. CNT Energy does not offer incentives directly, but program staff direct participants to incentives and financing options to cover retrofit costs. NYSERDA's MPP partners also advise participants on financing options, and include the building owner's plan for project financing in the Energy Reduction Plan, which details the project's scope of work. The LEAN Multifamily Program does not identify other financing options, as it provides incentives to cover the full cost of retrofits; and PSE&G's program fully finances retrofit costs through a combination of incentives and on-bill financing.
- Assisting building owners in selecting contractors. The comparison programs vary in their approach to measure installations: in some cases the program selects installation contractors, while in others the building owner selects an installation contractor, choosing from a program-qualified list for some programs, and without restriction for others. The programs through which building owners select installation contractors provide participants with support in developing bid request documents and reviewing bids.
- Verifying the quality of installed measures. All the comparison programs conduct inspections to verify the specified measures have been installed correctly.

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[62] As noted previously, all of the comparison programs view the multifamily building owners and managers, rather than tenants, as their participants. As a result, the program services described in this section target multifamily building owners and managers.

[63] LEAN uses WegoWise, benchmarking software, which was privately developed and is available to the public, NYSERDA and EOC use tools developed specifically for their programs.

In many cases, providing this level of support involves designating an individual to work with participating building owners and managers. The comparison programs broadly fall into two groups regarding the market actor designated to support participants: some draw on external consulting engineers, while others use internal program staff members. NYSERDA's MPP and PSE&G's program use consulting engineers to support participants throughout the retrofit process. These consulting engineers are professional engineers whose firms offer energy-efficiency consulting services in non-residential buildings, in addition to their multifamily program work. In both programs, these consulting engineers provide participants with support throughout the retrofit process. However, participants in the MPP contract with consulting engineers directly, while engineers supporting Residential Multifamily Housing Program participants work under contract to PSE&G.

Program staff members provide support to participants in EOC's, LEAN's, and CNT Energy's programs. EOC acts as a general contractor, managing the retrofit process for participants and subcontracting with installers to complete retrofit work. Staff at the organizations implementing the LEAN program guide participants through a complex participation process, bringing together distinct gas- and electric-efficiency offerings. CNT Energy uses its own staff to support participants throughout the process and to help them identify incentives and financing options for their retrofits. The EOC, LEAN and CNT Energy staff members that provide support to participants have construction and efficiency experience. EOC has an engineer on staff that supports the program, and EOC's project managers have construction and efficiency experience, including BPI training. LEAN staffs are BPI certified at a minimum and receive regular efficiency training to keep abreast of new technologies. CNT Energy largely provides technical training internally, but all the staff members engaged in supporting participants are BPI certified.

Assessment of Savings Opportunities

All the comparison programs provide participants with some level of building assessment or audit at no cost. Details about the differences between and assessment and audit are described below.

While PSE&G's program originally provided all participants with an investment grade (ASHRAE Level III) audit, the program found, in some cases, a less extensive, ASHRAE Level II audit proved sufficient. Due to the lower costs of these audits, cost savings improve the cost-effectiveness of individual retrofit projects and allow the program to serve a greater number of participants.

NYSERDA's MPP also uses ASHRAE Level II audits. NYSERDA uses its ERP tool, which it developed in collaboration with Oak Ridge National Laboratory and the U.S. EPA, to benchmark participating buildings and to estimate measure cost-effectiveness. The tool draws upon a database of approximately 500 multifamily buildings across the country. EOC conducts comprehensive audits and building modeling using procedures approved by the U.S. DOE for programs using federal weatherization funds.

In Massachusetts, the LEAN program offers varying assessment levels, based on the measure types and participants' needs. Most participants receive two distinct assessments:

- The program leverages existing utility efficiency offerings to provide appliance and lighting upgrades, and implementers, under contract to the utilities, conduct assessments focused on these measures.
- In a separate assessment, LEAN program staffs assess weatherization opportunities, and determine whether conducting detailed assessments will be necessary to identify central system upgrade opportunities.

If staff determine that central HVAC system savings opportunities exist, the program works with HVAC equipment manufacturers' representatives to specify upgraded equipment. The manufacturers' representatives send engineers to the building to generate detailed replacement specifications. Staff noted that drawing on manufacturers' representatives this way allows the program to avoid hiring an engineer to conduct a detailed audit of the HVAC system, thus reducing costs and increasing the range of measures that can meet the cost-effectiveness requirements.

CNT Energy program staffs conduct an audit of participating buildings, including inspections and diagnostic testing of building envelopes, mechanical systems, and lighting. This audit includes common areas and reviews of a sample of dwelling units. Following the advice of a marketing consultant, CNT Energy simplified the content of its audit reports, removing technical details about building characteristics and building science to focus more strongly on the costs and savings potential of recommended improvements.

Measure Installation

Variations in the comparison programs' requirements around measure installation largely parallel the differences in each program's method for supporting participants through the upgrade process.

NYSERDA and PSE&G, with programs drawing on consulting engineers to support participants, leave responsibility for selecting installation contractors to the building owners. In these programs, the role of the installation contractor is limited to implementing a pre-defined scope of work. The consulting engineers provide building owners with documents specifying the work to be completed and remain available to review bids and advise the building owner in the contractor-selection process. The building owner can select any contractor with the appropriate license to complete the work.

In contrast, the LEAN program in Massachusetts and the EOC program in Colorado, which use program staff to guide participants through the retrofit process, typically select the contractors to install measures in their participants' buildings. As noted, EOC acts as a general contractor, and installation contractors enter into a contract with both EOC and the building owner. EOC typically selects installation contractors through a competitive bidding process.

The LEAN multifamily program also typically selects installation contractors to install measures for participants. The program works with a group of contractors, with whom it has negotiated a set price for

labor and materials, although it may put installation work out to bid when very large projects allow the program to obtain prices lower than the negotiated prices. The LEAN program allows participants to select a contractor, if they choose to do so, but the contractor must agree to the program's pricing arrangements. As with specifying equipment, the LEAN multifamily program works with manufacturers' representatives to install central HVAC equipment. After developing the specifications, the manufacturers' representatives put the installation work out to bid among contractors the manufacturer has qualified to install its equipment.

Similar to the LEAN and EOC's programs, internal staff members of CNT Energy's multifamily program in Chicago guide participants through the retrofit process. However, participants in CNT Energy's program take responsibility for selecting their own contractors but CNT Energy staff helps participants solicit bids from licensed contractors.[64]

QA/QC Inspection and Verification

With the exception of CNT Energy, which does not directly incentivize measures, the comparison programs conduct post-installation inspections on all projects. Typically, the individual responsible for conducting the original building assessment and providing participant support conducts these inspections. EOC and LEAN draw on program staff to conduct the inspections, and the LEAN program encourages building owners and their maintenance staff to participate in the inspection as an opportunity to build their understanding of the building's energy use and the measures installed. CNT Energy staffs help coordinate inspections required by organizations incentivizing their participants' retrofits.

NYSERDA and PSE&G draw upon consulting engineers to conduct inspections, although PSE&G staffs conduct some inspections. The relationships consulting engineers have built with participating building owners and managers provide one reason NYSERDA draws on the Partners for inspections.

PSE&G and NYSERDA conduct an inspection at the midpoint of the measure installation process as well as once work has been completed. Inspections verify the progress of installation work, and, following the inspection, each program provides a partial incentive payment to the participant.

Incentives

CNT Energy's program in Chicago and the LEAN program in Massachusetts differ from the other in-depth comparison programs through their incentive offerings.

The CNT Energy program primarily plays a support role, guiding participants through the retrofit process. It does not offer incentives for measure installation, although the program disperses limited grant funding to support projects that staffs determine are unlikely to move forward without additional

[64] CNT maintains a list of "preferred" contractors, who have experience completing retrofits in multifamily buildings.

capital.[65] The LEAN multifamily program draws on a combination of direct installation, prescriptive measures, and performance-based incentives to fund the entire cost of retrofits, although building owners may contribute funding to install measures that the program's analysis has determined do not prove cost-effective, based on their energy savings.

All three of the remaining comparison programs offer performance-based incentives, although each structures its incentive offerings differently. All comparison programs offering incentives subsidize a relatively large portion of retrofit costs, with at least three of the four typically covering at least one-half of the retrofit cost. Nonetheless, only the LEAN Multifamily Program typically covers the full cost of retrofits to the building owner.

Table 48 summarizes each comparison program's incentive structure and the proportion of retrofit costs covered.

Table 48. Comparison Program Incentive Structure

Administrator	Program Name	Incentive Structure	Proportion Of Costs Typically Covered
CNT Energy	Energy Savers Multifamily Program	Program does not directly incentivize retrofits.	N/A
EOC	Low-Income Multifamily Program	Performance-based utility incentives; weatherization funds distributed based on a flat per-unit basis.	Approximately 50%
Massachusetts IOUs	LEAN Multifamily Program	Program covers full cost of measures.	100%
PSE&G	Residential Multifamily Housing Program	Qualified measures must have a simple payback of 15 years or less. Incentive levels are set to reduce the simple payback by up to 7 years, to not less than 2 years.	More than 50%
NYSERDA	MPP	Base per-unit incentive provided for savings of 15% above baseline; bonus incentives for buildings achieving savings of 20% or greater. Incentives are greater for low-income buildings and less for buildings not heated by utility-provided natural gas.	Unknown

Two comparison programs, in New York and New Jersey, provide participants with incentive payments in multiple installments over the course of the upgrade project. PSE&G staff explained the program pays

[65] These funds are expended on a discretionary case-by-case basis. It program staff think that a project will not proceed without the additional infusion of money, they will offer extra funds. Staff stated that this occurs most often for properties that are not eligible for loans.

these incentives to ensure property owners do not face barriers resulting from insufficient capital to cover installation costs that must be paid before a project can be fully completed.

In its role as a general contractor, EOC typically covers such costs for participants, as does the LEAN program, which fully subsidizes retrofits. Staff at both organizations noted their organizations' large size allows them to absorb these costs until incentives become available—an asset important to the programs' success.

Prior to installation, programs often require building owners to address any health or safety issues found during the building audit. For example, EOC requires owners to address lead or asbestos problems prior to installation of efficiency measures, and LEAN identifies "obvious health and safety problems" during audits, and requires those issues must be addressed before efficiency measure can be installed. In Massachusetts, some funds are available to help owners pay for required health and safety improvements.

Measures Installed

All the comparison programs install measures throughout multifamily facilities. Consistent with the performance-based incentives the majority of in-depth comparison programs offer, most of the programs place few restrictions on the types of measures that participants are allowed to install. All the comparison programs, however, require retrofits to meet cost-effectiveness requirements, in most cases at the measure level, as detailed in Table 49. LEAN and PSE&G program staff reported that cost-effectiveness requirements largely prevented their programs from subsidizing window replacements.

Table 49. Cost Effectiveness Requirements

Administrator	Program Name	Cost-Effectiveness Test	Level at Which Test Is Applied
CNT Energy	Energy Savers Multifamily Program	N/A – Program does not directly provide incentives.	
Energy Outreach Colorado	Low-Income Multifamily Weatherization Program	Savings Investment Ratio (SIR)*	Measure
		TRC	Program
Massachusetts IOUs	LEAN Multifamily Program	TRC	Measure
NYSERDA	MPP	TRC	Measure
PSE&G	Residential Multifamily Housing Program	Simple Payback	Measure

* Measures receiving federal weatherization funds.

The comparison programs differed somewhat regarding the extent that they provide direct-install measures, such as faucet aerators and CFLs. PSE&G and NYSERDA have distinct programs offering those measures, while their low-income multifamily programs focus on larger, whole-building upgrades. NYSERDA's program requires participants to achieve a minimum of 15% energy savings. In contrast,

LEAN and EOC typically provide a wider range of measures, from faucet aerators, CFLs, and appliances to boiler replacements, and not all participants must pursue larger upgrades.

NYSERDA and EOC provided the evaluation team with data on the frequency with which measures are installed. In NYSERDA's MPP, common area lighting, low-flow showerheads and faucet aerators, insulation, in-unit lighting, and refrigerator replacements are the most commonly installed measures, with each included in more than half of all MPP projects. EOC's energy savings primarily come from heating system upgrades (32%), in-unit, common area, and exterior lighting (27%), water heating and low-flow fixtures (14%), window replacement (12%), and insulation and air sealing (12%).

Financing

Three of the comparison programs—NYSERDA, PSE&G, and CNT Energy—offer financing to offset the upfront costs of efficiency upgrades in low-income multifamily buildings. Table 50 summarizes the details of each program's loan offerings.

Table 50. Financing Offerings

Comparison Program	Interest Rate	Loan Term
CNT Energy Savers Multifamily Program	3%	7 years
NYSERDA MPP	~50% of market rates	Unknown
PSE&G Residential Multifamily Housing Program	0%	Affordable housing: 10 years Market rate buildings: 5 years

PSE&G's program in New Jersey offers interest-free on-bill financing to cover the portion of upgrade costs not covered by incentives. NYSERDA offers financing through its Green Jobs Green New York (GJGNY) funding, and building owners in some New York utility territories may repay their loans through their utility bills.[66] Using GJGNY funds, NYSERDA provides participating lenders with one-half of the principal amount of loans made to support energy upgrade projects, interest free. This funding typically allows lenders to reduce the interest rate on energy upgrade loans by approximately 50%.

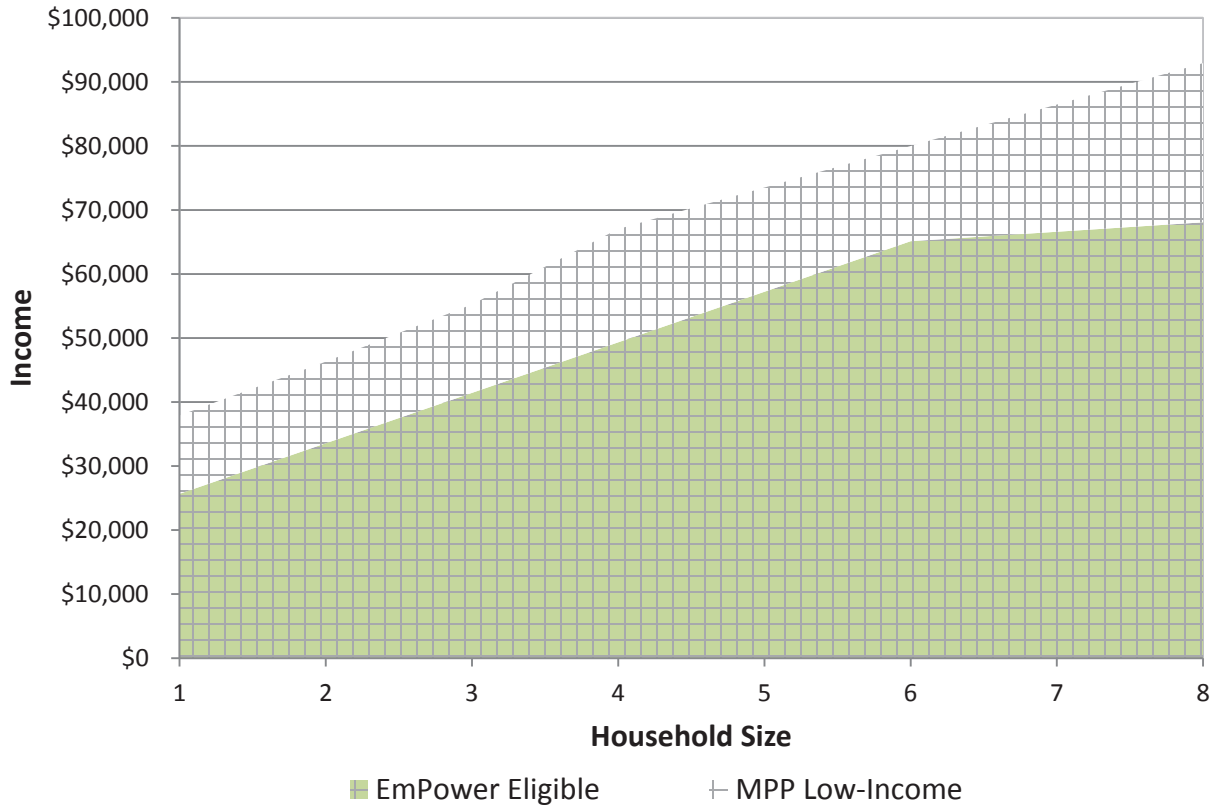
Coordination with Other Program Offerings

Each in depth comparison program coordinates with various other program offerings available to multifamily buildings within its jurisdiction. This coordination largely takes place through recruitment and referral of participants to the most appropriate program for the scope of improvements they express interest in undertaking.

[66] A statewide program, the GJGNY Program promotes energy efficiency and installation of clean technologies to reduce energy costs and greenhouse gas emissions. The program provides access to: no-cost and reduced-cost energy audits; installation services; low-cost, innovative financing through revolving loan funds; workforce development; job placement; and outreach by constituency-based organizations serving targeted communities.

If a multifamily property owner in New York cannot or will not pursue a comprehensive upgrade, MPP staff or Partners direct the participant to NYSERDA's EmPOWER program, which provides direct installation of energy-efficiency measures to income-qualified individuals living in buildings with 100 units or less. For buildings qualified for both programs, the availability of EmPOWER incentives could potentially complicate MPP recruitment and MPP eligibility.

Figure 52: MPP Low-Income and EmPOWER Eligibility



As the Figure 52 suggests, a large portion of low-income properties eligible for the comprehensive MPP low-income incentives are also eligible for the direct install measures provided by EmPOWER. MPP requires building owners to commit their own financial and time resources whereas EmPOWER is free to the owner and is minimally intrusive. The owner only has to grant permission for the EmPOWER staff to work with the buildings tenants to receive the in-unit measures. Therefore, EmPOWER could look more attractive to a building owner because s/he can receive some measures for their tenants without having to invest a lot of their time or effort. The comprehensive nature of MPP requires more time and money from the building owner. MPP offsets this effort by providing enhanced per-unit incentives for buildings that meet the income qualification threshold established by the program, but seeks to ensure that upgrades benefit tenants by requiring building owners to make all cost-effective in-unit upgrades in order to receive the larger incentives.

A building cannot participate in MPP if it participated in EmPOWER in the previous year. If a building participated in EmPOWER more than one year prior to potential participation in MPP, the savings obtained by EmPOWER measures may make it more difficult for a building to achieve the minimum of 15% savings required to participate in MPP.

In New Jersey, PSE&G staff can direct a participant to one of PSE&G's commercial programs if the building could not participate in the multifamily program. Once a participant enters NYSERDA's MPP or PSE&G's program, relatively little coordination with other programs takes place in delivering the retrofit.

The EOC, LEAN, and CNT Energy programs bring together services from a variety of efficiency programs, although all three seek to allow participants to access these resources through a single participation process. For example, as described, LEAN's program draws on existing utility offerings focused on lighting and appliances, in addition to the weatherization services LEAN staff members oversee. EOC uses a single application and assessment process to treat buildings using federal weatherization funds and utility funding.

CNT Energy coordinates the use of private monies, utility programs, and state programs to provide a one-stop shop for multifamily owners. Unlike EOC and LEAN, which directly provide incentives, CNT Energy identifies the programs most pertinent to a participant's circumstances and guides the participant through the program processes that best fit their circumstances.

Program Outcomes

This section provides information about each program's performance, and describes elements program managers cited as contributing to their program's success as well as remaining challenges the comparison programs face.

Program Performance

Limitations of Available Data

It proved difficult to obtain comparable data on which to evaluate the performance of the comparison programs and other programs serving the low-income multifamily sector using publicly available documents. A variety of factors contribute to this difficulty, including variations in reporting formats and requirements across jurisdictions, which can lead to data being reported at different detail levels.

For example, while EOC, LEAN, and NYSERDA report budgets and numbers of units served separately for gas and electric savings, PSE&G and CNT Energy report overall budgets and numbers of units served. As some facilities may receive only gas or only electric measures, while others receive both, it is not possible to aggregate figures on units treated with gas and electric measures for comparison with programs not distinguishing between gas and electric measures in their reporting.

The diversity of the comparison programs' funding sources also contributes to the difficulty of finding publicly available performance data.

Utility program administrators typically operate under relatively robust reporting requirements, although the assumptions underlying reported accomplishments may vary greatly across jurisdictions. However, many comparison programs draw on funding sources in addition to ratepayer funds, which may not require as detailed of reporting and may not make reports readily available to the public. In addition, programs operating with multiple funding sources may report to each funder only the accomplishments attributable to that source, rather than the program's overall achievements.

Program Accomplishments

Using available data, the research team compared the energy savings accomplishments of the comparison programs. As program budgets vary widely, the research team calculated three metrics designed to provide context for these comparisons:

1. Dollars spent per unit of energy savings (kWh or therm)
2. Energy savings per dwelling unit treated
3. Dollars spent per dwelling unit treated

Table 51 summarizes the comparison programs' electric energy savings accomplishments in 2012. When reviewing energy savings accomplishments, it is important to recognize that each program likely varies in its methods for deriving savings estimates and the assumptions that goes into those estimates.

In addition, energy savings accomplishments can be highly dependent on climate; for example, HVAC and shell upgrades may achieve larger heating fuel savings in colder climates. A diversity of climates exist in California, and the majority of the state's population lives in areas where space heating is less significant as an energy end-use and space cooling is more significant than in the comparison program areas. As a result, the cost and energy savings estimates listed here should be used for broad comparisons only.

Table 51. 2012 Comparison Program Electric Savings Accomplishments

Administrator	Program Name	Electric Spending	kWh Savings	Units Treated	Spending per kWh	kWh Saved per Unit	Spending per Unit
NYSERDA[1]	MPP	$8,989,473	32,542,000	10,136	$0.28	3,211	$887
Massachusetts IOUs	LEAN Multifamily Program	$16,500,000	17,600,000	14,500	$0.94	1,214	$1,138
EOC[2]	Low-Income Multifamily Program	$306,160	1,132,806	1,900[3]	$0.27	596	$161
CNT Energy	Energy Savers Multifamily Program	Not Reported	1,858,715[4]	Not Reported			
PSE&G	Residential Multifamily Housing Program		1,839,500				

1. Figures reflect projected spending and savings; actual accomplishments were not available. Figures reflect only low-income buildings.
2. Figures reported reflect only funding from Xcel Energy and associated accomplishments.
3. Estimated based on number of buildings served with Xcel funding (38), assuming 50 units per building, based on figures in EOC's annual report (62 buildings and 3,096 units treated with utility funding).
4. Complete projects only.

Among the three programs listed in Table 51 with complete data available, EOC's program in Colorado spent the least and achieved the lowest energy savings per unit treated. However, the figures in the table only reflect funds EOC received from Xcel Energy and the associated savings. As EOC brings together multiple funding sources to support the buildings it treats, some units listed in Table 51 may have received additional funding and achieved energy savings not reflected in these figures. EOC provided the research team with data on overall program spending and units treated, but did not break these data out between gas and electric measures. According to EOC staff, the program spends an average of $2,828 per unit,[67] putting the program's spending more in line with that of NYSERDA and LEAN. While NYSERDA and LEAN spend roughly comparable amounts per unit treated, NYSERDA's anticipates much higher energy savings than LEAN has achieved.

[67] This figure excludes measures installed in partnership with the Mile High Youth Corps in order to provide a more accurate sense of costs associated with the more comprehensive retrofit projects described in this section. Through its partnership with Mile High Youth Corps, EOC provided low-cost measures to a large number of multifamily units.

Table 52 summarizes the comparison programs' gas savings accomplishments in 2012. NYSERDA achieved considerably higher therm savings per unit than the comparison programs.

Table 52. 2012 Comparison Program Gas Savings Accomplishments

Administrator	Program Name	Gas Spending	Therm Savings	Units Treated	Spending per Therm	Therms Saved Per Unit	Spending per Unit
NYSERDA[1]	MPP	$13,613,911	1,531,050	5,829	$9	263	$2,336
Massachusetts IOUs	LEAN Multifamily Program	$18,600,000	1,100,000	6,700	$17	164	$2,776
EOC[2]	Low-Income Multifamily Program	$503,416	14,390	900[3]	$35	16	$559
CNT Energy	Energy Savers Multifamily Program	Not Reported	679,200	Not Reported			
PSE&G	Residential Multifamily Housing Program		351,676[4]				

1. Figures reflect projected spending and savings, actual accomplishments were not available. Figures reflect only low-income buildings.
2. Figures reported reflect only funding from Xcel Energy and associated accomplishments.
3. Estimated based on the number of buildings served with Xcel funding (38), assuming 50 units per building, based on figures in EOC's annual report (62 buildings and 3,096 units treated with utility funding).
4. Complete projects only.

To allow comparisons between programs reporting aggregate spending figures and those that break spending out between gas and electric measures, the research team converted each comparison program's gas and electric savings accomplishments to million British Thermal Units(MMBTU), and added these to create a figure for overall program energy savings, as shown in Table 53. Overall, NYSERDA and CNT Energy spent the least per MMBTU saved, which likely reflects the higher incentives offered by the other programs.

Table 53. Comparison Program Combined MMBTU Savings Accomplishments

Administrator	Program Name	Total Spending	MMBTU	Spending per MMBTU
NYSERDA[1]	MPP	$22,603,384	264,138	$86
Massachusetts IOUs	LEAN Multifamily Program	$35,100,000	170,051	$206
CNT Energy	Energy Savers Multifamily Program	$ 5,269,094	74,196	$71
PSE&G[2]	Residential Multifamily Housing Program	$14,042,457	41,510	$338
Energy Outreach Colorado[3]	Low-income Multifamily Program	$809,576	5,304	$153

1. Figures reflect projected spending and savings, actual accomplishments were not available. Figures reflect only low-income buildings.
2. Complete projects only.
3. Figures reported reflect only funding from Xcel Energy and associated accomplishments.

Due to the differences in the size of the multifamily segment in each of the areas the comparison programs serve, the research team also compared total program spending and MMBTU savings per multifamily dwelling in each program's service area (Table 54). Among the comparison programs, the LEAN multifamily program spends the most, although it also achieves the largest energy savings relative to the number of multifamily units in its service area.

Table 54. Comparison Program Spending and Savings by Multifamily Units in Service Area

Administrator	Program Name	Multifamily Units in Service Area [1]	Total Spending	MMBTU	Spending/Unit in Service Area	MMBTU/Unit in Service Area
NYSERDA[2]	MPP	2,614,244	$22,046,584	373,652	$8.43	0.14
PSE&G	Residential Multifamily Housing Program	625,713[3]	$14,042,457[4]	41,510	$22.44	0.07
CNT Energy[5]	Energy Savers Multifamily Program	873,545[5]	$5,269,094	74,196	$6.03	0.08
Massachusetts IOUs	LEAN Multifamily Program	569,075	$35,100,000	170,051	$61.68	0.30
EOC[6]	Low-Income Multifamily Program	450,678	$809,576	5,304	$1.80	0.01

1. US Census Bureau, American Community Survey, 2007-2011, 5 year estimates, Table B25024; generated using American Fact Finder.
2. Figures reflect projected spending and savings, actual accomplishments were not available. Figures reflect only low-income buildings.
3. This is an estimate of PSE&G service territory. This value consists of the New Jersey Counties of Bergen, Burlington, Camden, Essex, Gloucester, Hudson, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, and Union.
4. Complete projects in 2012
5. Consists of the Illinois Counties of Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will.
6. Figures reported reflect only funding from Xcel Energy and associated accomplishments.

The programs selected for in-depth comparison operate in areas with climates very different from much of California. It is important to consider these differences in climate in comparisons of the energy savings accomplishments of the various programs and the cost effectiveness of the measures they offer. However, low-income tenants and multifamily building owners across the country likely face similar considerations in their decisions regarding energy efficiency. As a result, the comparison programs' established and well-documented approaches to reaching the low-income multifamily sector may provide insight into program delivery approaches that could be effective in California.

Successful Program Elements

In addition to the program approaches discussed, three elements arose in interviews with multiple comparison program managers as having contributed to their programs' success:

- **Organizational experience:** As noted in the "Program Administration" section, many organizations implementing the comparison programs had considerable experience working with low-income populations and delivering efficiency programs. EOC and LEAN program staff cited this experience as valuable in allowing them to launch their programs quickly and smoothly. For example, LEAN program staff could draw upon existing relationships with stakeholders to gain buy-in on their program.
- **Building owner education:** A lack of energy-efficiency knowledge among building owners presented a barrier many comparison programs sought to address, and comparison program staff cited advances in building owner knowledge as a factors contributing to their programs' success. Managers of multiple comparison programs noted that, after completing a retrofit project, building owners frequently returned to the program to retrofit other buildings in their portfolio. EOC staffs attribute this repeat participation to an increase in the building owner's awareness of energy use in their buildings.
- **Comprehensive focus:** All comparison programs encourage multifamily owners to address the full range of savings opportunities in their buildings through comprehensive audits and performance-based incentives. NYSERDA and PSE&G's programs most strongly focus on achieving deep energy savings. NYSERDA program staff noted that achieving savings exceeding initial projections, as MPP projects often do, can motivate building owners to enroll other properties in the program.

Remaining Challenges

Multiple comparison program managers also described three factors that continue to pose challenges to their programs.

- **Multifamily retrofit timelines:** PSE&G staff reported multifamily retrofit projects can take as long as 24 months, making it difficult for projects to fit within typical efficiency program reporting cycles. Long lag times can occur between an audit and the time a customer decides to participate in the program. Customers also may need significant time to procure a contractor and negotiate a contract. LEAN program staff reported that experience with these long project lead times played a role in the program's decision to fully subsidize retrofits. By paying the full cost of retrofits, LEAN seeks to eliminate the need for building owners to negotiate installation costs and piece together financing packages.
- **Multifamily building financing structures:** EOC staff noted that multifamily buildings often operate using complicated financing structures, and may have limited ability to take on additional debt. Further, differences in existing financing arrangements for individual buildings in a multifamily complex may result in some buildings having more capital available for upgrades than others, and it may not be possible to transfer capital to buildings with the greatest need for retrofits. In response, EOC seeks to develop a financing program following an ESCO model, in

which EOC would arrange financing for participants, with the expectation that the project's energy savings would cover the loan payments. PSE&G's on-bill repayment option also addresses this challenge by providing building owners with an opportunity to finance efficiency retrofits without procuring a traditional loan.

- **Cost-effectiveness:** All comparison programs required projects to meet cost-effectiveness requirements, in many cases at the measure level. Comparison program managers reported that low natural gas prices made it more difficult to meet cost-effectiveness requirements and limited the range of measures their programs can install. Comparison program managers have taken a variety of steps to reduce overall project costs, including, when feasible, providing less comprehensive audits and working with manufacturers' representatives to specify and install equipment, boosting project cost-effectiveness.

Section 6. The Current California Landscape for Low-Income Multifamily Programs

This section, which presents a summary of California's low-income multifamily energy-efficiency program landscape in California, discusses the following:

- Overarching goals for multifamily efficiency programs, drawing on the California Energy Efficiency Strategic Plan, Commission decisions, and the Multifamily Subcommittee of the Home Energy Retrofit Coordinating Committee (MF HERCC) report.
- Efficiency programs targeting multifamily building owners and their tenants and interactions between the various programs.

This summary draws on in-depth interviews with IOU program staff, as well as a review of documents including program implementation plans, Commission decisions, and evaluation reports.

Overarching Goals

The research team reviewed three documents that express overarching goals guiding the design of programs serving the low-income multifamily sector in California: the California Energy Efficiency Strategic Plan, Decision 12-08-044, and the Multifamily Home Energy Retrofit Coordinating Committee (MF HERCC) report on multifamily program design. The three documents build on each other, and all three address three broad goals for efficiency programs targeting the low-income multifamily sector:

- Addressing the full range of efficiency opportunities in participating buildings
- Streamlining program processes and program delivery
- Targeting outreach to most effectively reach multifamily buildings.

The following sections provide details about the goals laid out in each document.

Strategic Plan

Three of the goals listed in the Strategic Plan relate to the low-income multifamily sector: the core residential sector goal of implementing a whole-building approach to efficiency (Goal 2) and the two goals for the low-income sector: giving all willing and eligible customers the opportunity to participate in the ESA Program by 2020 and delivering long-term, cost effective savings. Also, the Strategic Plan notes that adopting a whole-building approach to energy efficiency will require a shift in program design from promoting individual measures to promoting packages of measures that address a more comprehensive range of efficiency needs within each building. The Strategic Plan also states that an increase in customer awareness of energy efficiency is necessary to build demand for whole-building retrofits.

The Strategic Plan's goal of serving all eligible and willing low-income customers by 2020 requires the ESA Program to increase the pace at which it reaches these households. The Strategic Plan suggests that the ESA Program should improve the efficiency of program delivery through both targeted outreach and leveraging service providers like community-based organizations.

In order to deliver long-term, cost effective savings – the second goal for the low-income sector – the Strategic Plan suggests that the ESA Program will have to increase its coordination with both non-IOU programs serving the low-income sector and core efficiency programs. The strategic plan also suggests that the ESA Program focus on the longest-lasting and most cost-effective measures.

Decision 12-08-044

In August 2012, the Commission released Decision 12-08-044, which directed the IOUs to immediately roll out eight strategies to better serve the low-income population residing in multifamily buildings. These eight strategies address three broader approaches to serving low-income multifamily buildings:

1. **Streamlining program delivery:** The Decision's Strategy 7 is to "streamline practice and service delivery," but other strategies, including the Whole Neighborhood Approach (Strategy 1) and same day enrollment, assessment, and installation (Strategy 6) also broadly seek to increase the efficiency with which the IOUs deliver the ESA Program and simplify the participation process.
2. **Addressing a wider range of efficiency needs in multifamily buildings:** In the Decision, the Commission declines to expand the ESA Program's measure offerings to include replacement of functioning central systems in multifamily buildings, citing the substantial increase in budget that would be required to support these installations. Instead, the Decision presents strategies to meet a broader range of efficiency needs through retaining some ESA Program measures proposed for retirement (Strategy 8), and coordinating ESA Program offerings with other programs serving multifamily buildings (Strategy 4). The Decision directs the IOUs to establish a single point of contact for multifamily building owners that would support this coordination (Strategy 5).
3. **Increasing direct outreach to multifamily building owners and managers:** Consistent with its focus on serving low-income households, the ESA Program's outreach primarily targets individual ratepayers, rather than building owners. However, the Decision notes that there are benefits in directly reaching out to property owners and managers as well (Strategy 3). In support of improving outreach to building owners and managers, the Decision also directs the IOUs to update the ESA Program's Property Owner Waiver form to create a simplified, uniform document for use across IOUs (Strategy 2).

These three broad approaches—which support each other—are consistent with the Strategic Plan's goals of moving building owners toward a whole-building. For example, providing direct outreach to building owners is necessary to promote the strategies for streamlining program delivery (such as the Whole Neighborhood Approach). The evaluation team notes that these strategies are likely to require ESA Program staff and contractors to coordinate with building owners to a greater extent than would be necessary to treat an individual unit.

MF HERCC Report

The U.S. EPA Region 9 convened the California Home Energy Retrofit Coordinating Committee (HERCC) to develop consensus-based energy upgrade program recommendations. In October 2010, the multifamily sub-committee of the HERCC released a report entitled *Improving California's Multifamily Buildings: Opportunities and Recommendations for Green Retrofit & Rehab Programs* (MF HERCC report). In a guidance decision for the IOU's mainstream energy-efficiency portfolios issued in May 2012 (Decision 12-05-015) the Commission directed the IOUs to consider the MF HERCC report in their designs for the Energy Upgrade California (EUC) Multifamily Path. The IOUs' plans for EUC Multifamily Path are largely consistent with the HERCC report.

Stopwaste, Alameda County's Waste Management Authority and Source Reduction and Recycling Board, chairs the multifamily sub-committee of the HERCC. The MF HERCC report lists 90 individuals representing 42 organizations as MF HERCC participants. Government, utilities, and representatives of organizations involved in efficiency program implementation make up the largest groups of MF HERCC participants. Table 55 summarizes the types of organizations represented in the MF HERCC.

Table 55. MF HERCC Participants

Organization Type		Number of Organizations Represented	Number of Members
Government	Local Government	7	19
	State Government	4	11
	Federal Government	4	7
Utilities	IOU	4	14
	Municipal	1	1
Program Implementers		10	21
Advocacy Groups		5	8
Contractor Training & Certification (BPI, HERS)		3	5
Software Providers		2	2
Other		2	2
Total		**42**	**90**

The MF HERCC report goes into greater detail on program design than the documents described above, but many of the report's recommendations address similar overarching goals. The report argues that delivering whole-building energy efficiency to multifamily buildings will require a distinct approach from those being implemented in the single family sector. The report describes a performance-based whole-building efficiency program design that seeks to address the unique needs of multifamily building owners.

Key elements of the program design the MF HERCC report proposes include designating a single point of contact to direct building owners to the efficiency program or programs that best meet their needs and guide them through the participation process. The report also recommends a program delivery structure centered on Home Energy Raters (HERS raters), who would be involved in building assessments and

developing the scope of work, ensuring that installation contractors are qualified and verifying installations once they are complete. Due to the complexity of large upgrade projects in multifamily buildings, the report argues that it is important that building owners be free to choose their own contractors to complete retrofit work.

The report notes that a role remains for less comprehensive multifamily efficiency programs to serve buildings that are not prepared to commit to a larger retrofit. It also suggests ways that multifamily buildings serving low-income tenants could draw on low-income program offerings in addition to performance-based multifamily programs and proposes opportunities to streamline delivery of those services. In order to facilitate participation in multiple programs for multifamily buildings, the report suggests developing uniform procedures and requirements across programs, for example standardizing energy audit protocols across programs and taking steps to make it easier for a single installation contractor to install measures that receive incentives through different programs.

The report also recommends that low-income programs move toward a whole-building approach that includes support for common area and central system measures and streamline their procedures for verifying income eligibility. To streamline income eligibility procedures, the report recommends that low-income programs should broaden their categorical eligibility policies to accept participation in a wider range of other income-qualified programs as proof the building qualifies. The report also recommends that low-income programs allow owners of subsidized multifamily properties who maintain records of tenants' incomes to provide income qualification information for their tenants and authorize energy upgrade work.

Programs Serving Multifamily Buildings

The research team identified a wide range of programs in its efforts to create a catalog of programs serving the low-income multifamily sector in California. However, many of these programs serve only limited areas of the state, and are thus less relevant to a broad understanding of the statewide efficiency program context. This section focuses on the four statewide programs most relevant to the low-income multifamily sector: the ESA Program, the federally funded weatherization program administered by the California Department of Community Services and Development (CSD Program),[68] the Multifamily Energy Efficiency Rebate (MFEER) program, and whole-building efficiency programs including the IOUs' Energy Upgrade California Multifamily Path (EUC MF Path) and the multifamily programs offered by the Bay Area Regional Energy Network (Bay REN) and the Southern California Regional Energy Network (SoCal REN).

[68] CSD administers weatherization programs with funding primarily from the U.S. DOE's Weatherization Assistance Program (WAP) and the U.S. Department of Health and Human Services' Low-income Home Energy Assistance Program (LIHEAP), although the program also received American Recovery and Reinvestment Act stimulus funds.

The following sections compare the following aspects of each program.

1. **Background**: This section provides some context and general information about each program. Topics include regulatory context and recent budgetary changes.
2. **Eligible Measures**: This section examines the measures each program typically provides.
3. **Primary Outreach**: The principal methods used for reaching potential participants are discussed in this section. When available, survey findings reported in past process evaluations inform this section.
4. **Participant Eligibility**: This section compares the building types and income levels that determine eligibility for each program. Eligibility for these programs is determined by either income or building type.
5. **Incentive Schedules**: A comparison of the types of incentives provided by each program is discussed in this section. The comparison examines if the programs provide direct installation of measures, prescriptive incentives, or custom/performance related incentives. In addition, the section summarizes how much of the project cost a participant is expected to cover.
6. **Assessment/Audit**: This section compares how each program determines the efficiency needs of a building. In some cases a simple walk through assessment is provided while in other cases an investment grade audit is required.
7. **What is asked of the Participant**: This section describes the requirements of each participant for each program and defines whether a participant is a building owner or resident.

Background

As indicated above, the evaluation team elected to describe the four programs most pertinent to the multifamily market. Two of these programs target low-income households, and two seek to serve multifamily buildings as a whole (Table 56). For the programs targeting low-income households, the tenants in multifamily buildings make the decision to participate and are primarily responsible for interacting with the program, although building owners may have to authorize upgrades. For the programs targeting multifamily buildings, the building owner or their representative makes the decision to participate and primarily interacts with the program.

Table 56. Definition of Participant in Programs Serving the Multifamily Sector

Program	Participants
ESA Program	Tenants
CSD (WAP/LIHEAP)	Tenants and building owners
MFEER	Building owners
Whole House	Building owners

This section provides context and general information about each program.

Table 57 shows how the four programs compare to one another across 12 characteristics.

Table 57. Summary of Four Programs Most Pertinent to Low-Income Multifamily Programs

Program Characteristics		ESA Program	WAP/LIHEAP	MFEER	Whole House
Program Administrator		IOUs	Comm. Serv. Agencies	IOUs	IOUs and Local Government
Exclusive Multifamily Program		No	No	Yes	Yes
Exclusive Low-income		Yes	Yes	No	No
Regional Coverage		IOU territory	Statewide	IOU territory	5 regions in state[1]
Funding		Ratepayer	Taxpayer	Ratepayer	Ratepayer
Incentive Structure	Direct Install[2]	Yes	Yes	No, but incentives may cover full measure cost	No
	Prescriptive[3]	No	No	Yes	No
	Custom/ Performance[4]	No	No, but energy audit software may be used to determine measure cost-effectiveness	No	Yes
Incentives		Measures installed at no cost to tenant[5]	Measures installed at no cost to tenant	Incentive offsets project cost but may cover full cost in some cases[6]	Incentive offsets project cost
Primary Measures Installed		Weatherization, lighting, appliances	Weatherization, lighting, appliances	Lighting in electric utilities; hot water saving in SCG	TBD – Program recently launched
Building Area Covered by Program		Tenant Area Only	Tenant and Common[7]	Tenant and Common	Tenant and Common
Investment Grade Audit	Audit Required	No	No[8]	No	Yes
	Who Completes Audit	N/A	N/A	N/A	HERS II Multifamily Raters
"Clipboard" Assessment[9]	Assessment Required	Yes	Yes[8]	No	No
	Who Completes Assessment	Program Staff	Program Staff	N/A	N/A

1. The 5 regions are: 9 counties in Bay Area, Sacramento County, Los Angeles County, Marin County, San Diego County
2. In a direct install program, the contractors who install measures work under contract to the program administrator. Direct install programs typically provide measures at little or no cost to the participant.

3. Prescriptive incentives provide a set rebate amount for installation of specific measures.
4. Custom/performance incentive amounts are based on project-specific energy savings estimates. These estimates depend on the pre-retrofit characteristics of the building or equipment, and may take into account factors including the actual duty cycle of the equipment and interactions between multiple measures.
5. In renter-occupied units where the refrigerators are owned by the owner, the program offers to pay for a portion of replaced refrigerators, not 100% of the cost.
6. MFEER offers per-measure, prescriptive incentives. However, for some lighting retrofits these incentives cover the full retrofit cost, allowing participants to receive measures at no cost.
7. CSD's program treats common areas in buildings that meet its income qualification requirements. If a building does not meet the requirements, CSD installs in-unit measures in units occupied by income-qualified tenants.
8. CSD's program requires an energy audit in buildings receiving whole-building weatherization upgrades. These audits are completed by a professional energy auditing consultant. The program conducts clipboard assessments for units treated under its individual unit approach.
9. A "clipboard assessment" is a checklist inventory or survey of a building. A "clipboard assessment" less comprehensive than an investment grade audit which involves taking measurements and conducting an analysis of the building.

To provide a sense of the relative size of the various programs, Table 58 lists the 2013-2014 budgets for the statewide programs serving the low-income multifamily sector. The ESA Program has the largest budget of all the programs considered.

Table 58. 2013-2014 Program Budgets

Program		PG&E	SCE	SCG	SDG&E	Total
ESA Program	Total	$330,969,000	$127,499,000	$166,300,360	$45,294,193	$670,062,553
	Multifamily Only (Est.)*	$59,574,420	$29,324,770	$41,575,090	$24,458,864	$154,933,144
MFEER		$5,189,025	$23,495,961	$2,767,910	$3,402,589	$34,855,485
Whole Building	MF EUC	$5,630,116	$2,831,867	$1,000,000	$2,501,496	$11,963,479
	So Cal REN					$9,543,801
	Bay REN					$7,293,750
CSD Programs(2013 only)						$39,423,628

* Estimates based on proportion of multifamily households relative to all households treated by the ESA Program between 2007 and 2010, as listed in D.12-08-044.

The following section provides a general description of each program.

Energy Savings Assistance (ESA) Program

The ESA Program is a direct install program that serves all low-income IOU customers, including single-family residences, multifamily residences, and mobile homes. The ESA Program does not significantly distinguish its services between multifamily and single family residences. The same eligibility, measure, and income requirements apply to both single family and multifamily residents, the same groups of contractors deliver the program to single family and multifamily residences, and the participation process is the same regardless of the participant's dwelling type.

The ESA Program serves both renters and homeowners. In order to provide some services to renters, the ESA Program requires building owners to sign a Property Owner Waiver form, authorizing efficiency improvements.[69] The ESA Program also requires building owners to provide a co-payment for replacement of older, inefficient refrigerators in tenant units when the building owner owns the refrigerator and the tenant does not pay the electric bill, although ESA Program staff noted that both of these conditions rarely occur. The ESA Program provides refrigerator replacement at no cost to low-income households that own their refrigerator or directly pay their electric bills.

The ESA Program provides income-qualified residents of multifamily buildings with direct installation of retrofit measures to manage their energy use and save money on their monthly energy bills at no charge. Measures installed include, CFL lights, air sealing, low-flow fixtures, and replacing refrigerators. In multifamily buildings, all of ESA's improvements are made within the qualified participants' dwelling units; the program does not treat central systems or common areas. Each IOU in the state administers the ESA Program for their service territory and provides the same general service across the territories. Differences, both within and across IOU exist in terms of the specific eligible measures the program installs. These differences are determined, in part by climate zone, relative need (either as per savings or for health, comfort, and safety) and fuel source.

Unlike the other IOU multifamily programs discussed below (MFEER and the whole-building programs), the ESA Program focuses on serving households, not building owners. Thus, the outreach efforts have traditionally been aimed at the building residents. This focus on residents means that services may be delivered unit by unit as opposed to installing measures for an entire building at once. However, many ESA Program contractors target multifamily buildings in low-income areas and work with building owners and managers to gain access to an entire property and enroll all eligible residents at the same time so that they can work through the entire building at once. ESA Program participants also need permission from their landlord to receive measures, which can be a barrier to participation since some landlords are difficult to reach or unresponsive to the program's efforts.

Utilities have increased their outreach to building owners in order to gain access to an entire property. However, once the building owner has given the program permission to treat a building, the program typically must verify the eligibility of households within the building individually prior to delivering services to those households. In some cases, this verification can be a time-consuming process. The IOUs have also simplified the income verification process for the ESA Program. The program has identified areas where census data suggest there is a high concentration of low-income households and relaxed income verification requirements for participants in these areas. In addition, the program can treat all units in a multifamily building if it finds that 80% of the residents are income qualified.

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[69] The ESA Program Policies and Procedures Manual states that, with prior authorization form the IOU program manager, ESA contractors may provide "services and measures that do not directly affect the condition and/or structure" of renter-occupied units without obtaining a signed Property Owner Waiver.

CSD Programs

The California Department of Community Services and Development (CSD) combines funds from the U.S. Department of Energy's (DOE) Weatherization Assistance Program (WAP) and the U.S. Department of Health and Human Services' (HHS) Low-income Home Energy Assistance Program (LIHEAP) to deliver weatherization services to low-income Californians. These funds are available for residents of single family and multifamily buildings, and these funds support all measure costs that meet the program's cost effectiveness criterion.[70] In 2013, CSD received $1,523,628 from the DOE's WAP and an additional $37.9 million dollars from HHS's LIHEAP.[71] CSD distributes these funds to 40 community action agencies around the state who administer the program for each of California's 58 counties.[72] For the remainder of this report these funds are referred to as CSD funds.

ARRA money heavily supported weatherization services from 2009-2012. Over $166 million of ARRA money went to the community action agencies, allowing them to weatherize 59,066 homes between 2009 and 2012.[73] Additionally, California received about $40 million dollars in 2012 from DOE WAP and from HHS's LIHEAP, meaning CSD had a total of about $81 million dollars to spend on weatherization in 2012. The $39.4 million investment in weatherization services by DOE and HHS for 2013 represents less than half of the weatherization spending in 2012, suggesting there will be a large decline in the number of residences CSD will serve in 2013.

CSD funds are used to reduce the heating and cooling costs for low-income families by improving the energy efficiency of their homes and ensuring their health and safety. DOE WAP funds emphasize efficiency whereas the LIHEAP funds emphasize bill reduction and improving health and safety conditions. In delivering its services, the program prioritizes those households with elderly residents, individuals with disabilities, and families with children.

Like the ESA Program, the CSD Programs historically have not distinguished their services between single family and multifamily buildings; the programs provided in-unit measures to multifamily units that eligible participants occupied. However, with the influx of ARRA funding, the CSD programs began to test a more whole-building-focused approach to multifamily properties. The programs expanded their

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[70] Under the federal weatherization programs, a measure must achieve a savings-to-investment ratio (SIR) of 1.0 or greater, meaning that, over the expected life of the measure, the energy cost savings will equal or exceed the measure cost. If they choose to do so, building owners can use their own funds to 'buy down' a measure's cost to the program so that it will achieve a SIR of 1.0.

[71] Department of Energy Weatherization Program Notice 13-2. http://waptac.org/data/files/website_docs/government/guidance/2013/wpn-13-2.pdf (Accessed August 14, 2013)

[72] For a list of all CSD program service providers see the following California Community Services and Development website. http://www.csd.ca.gov/Services/FindServicesinYourArea.aspx (Accessed 8/7/13)

[73] The sum of awards listed by CSD show a total of about $166 million were awarded through ARRA. www.csd.ca.gov/NewsRoom/NewsReleases/October30,2012/StatewideWeatherizedHomesBreakout.aspx

services to provide central system and common area measures and whole-building infiltration measures to qualified multifamily buildings. The programs provided these measures at no cost to the participating households or the building owner.

In order to qualify for these expanded measures buildings had to appear on a list of subsidized and tax credit properties created by DOE and HUD, or at least 66% of the units had to be individually income qualified.[74] All of the buildings that received whole-building retrofits through the CSD program provide subsidized housing or receive tax credits as low-income housing. According to CSD staff, due to significant budget restrictions it is unlikely the CSD programs will continue to provide whole-building multifamily services going forward. This contact noted that, with limited budgets, it would be difficult for the locally-based community action agencies that deliver the program to justify committing a large amount of funding to a multifamily retrofit project since doing so could limit the services available to the rest of the agency's service area.

Multifamily Energy Efficiency Rebate Program (MFEER)

The MFEER program is a utility ratepayer-funded residential program that promotes rebates for qualified energy- efficient improvements in apartment dwelling units, common areas of apartment and condominium complexes with two or more units, and common areas of mobile home parks. The MFEER program is administered by the four IOUs in California and is promoted by trade allies that serve the multifamily marketplace. MFEER is not income qualified. Any multifamily building owner with more than two units is eligible to participate.

MFEER largely provides lighting and water saving measures at no or very small cost to participating building owners, once they (or their contractor) receive their rebates.

Whole Building Programs

All four IOUs included plans for Energy Upgrade California Multifamily Path (EUC MF) programs in their approved 2013-2014 Program Implementation Plans (PIPs). PG&E, SCE, and SCG plan to pilot their EUC MF offerings, while SDG&E will move to full implementation drawing on the experience of the pilot in San Diego County. These programs aim to encourage multifamily building owners to undertake large-scale, comprehensive retrofits. They will offer building owners performance-based incentives for efficiency improvements and support as they navigate the retrofit process. The Bay Area Regional Energy Network (Bay REN) and the Southern California Regional Energy Network (SoCal REN) have also proposed multifamily programs that seek to bring about more comprehensive upgrades than those

[74] This list includes buildings receiving federal subsidies from the Department of Housing and Urban Development, the U.S. Department of Agriculture, as well as city and county affordable housing properties and properties receiving Low-income Housing Tax Credits through the California Tax Credit Allocation Committee.

typically conducted through MFEER.[75] Since these programs all target similar types of large retrofit projects, this document groups them together under the heading of whole-building programs. All of these programs primarily seek to achieve energy savings; unlike the ESA and CSD Programs, improving the comfort, health, and safety of building tenants is not a primary objective.

The whole-building programs draw on the experience of a variety of municipalities across California, including Alameda County, Los Angeles County, and San Diego County, which used ARRA stimulus funding to implement multifamily energy-efficiency programs under the Energy Upgrade California (EUC) umbrella. With the exception of Bay REN (discussed below), the whole-building programs are focused on serving property owners interested in taking on large energy-efficiency projects. They will seek to leverage the major rehabilitation projects that multifamily properties periodically undergo, targeting properties that are planning to complete, or are in the process of completing, major renovations. In many ways, the whole-building program designs parallel the recommendations of the MF HERCC report, although differences exist in program delivery among the utilities and RENs. Table 59 summarizes key elements of the whole-building programs, and the following sections describe each element in additional detail.

[75] In Decision 12-11-015, the Commission authorized the formation of two Regional Energy Networks (RENs): Bay REN and SoCal REN. Both RENs are made up of a collection of local governments in their respective areas. In contrast to the IOUs existing Local Government Partnerships, the Commission (rather than the IOUs) reviews and approves REN proposals and REN programs operate outside of the IOUs' portfolios. Although the IOUs do not have authority over the RENs' program designs, they will manage the RENs' contracts.

Table 59. Key Characteristics of MF EUC Programs

Characteristics		SoCal REN		SCE/SCG	SDG&E	Bay REN	PG&E		
Qualified Buildings		5 or more units		3 or more units 4 stories or less	Not specified	5 or more units	5 or more units		
Audits	Scope	ASHRAE Level II		Investment grade	Investment grade	Building owner-provides software inputs; technical assistance completes energy model and on-site verification	Investment grade		
	Auditor	Participant contracts with approved rater/analyst		Contractor to program	Participant contracts with approved rater/analyst	N/A	Participant contracts with approved rater/analyst		
	Audit Subsidy	Number of Units	Subsidy	No cost to participant	None for audit alone, but incentive levels include $100 per unit for costs of energy modeling and combustion safety testing.	N/A	Number of Units	Affordable	Market Rate
		5-20 units	$5,000				5-30	$5,000	$2,500
		21-50 units	$10,000				31-100	$10,000	$5,000
		Incremental per unit >50	$20				Incremental per unit >100	$20	$10
Installation Contractors		Participant selects		Participant selects	Participant selects	Participant selects	Participant selects, but contractors must enroll in EUC and attend a pilot information session.		
Per-unit Incentive*	10%	$200		$700	$550	$750 (8-12% savings anticipated)	TBD, but anticipate average of $1,000 per unit.		
	15%	$400		$800	$625				
	20%	$700		$1,000	$800				
	25%	$950		$1,200	$1,000				
	>30%	$1,200		$1,400	$1,350				
	>35%			$1,600					
	>40%				$1,500				

* Incentive amounts are based on the number of units in a participating building. The total incentive the building owner receives is the product of the per-unit incentive amount and the number of units in the building.

As Table 59 suggests, Bay REN's whole-building offering differs from those of the IOUs and SoCal REN. Bay REN's offering targets energy upgrade projects with smaller budgets and more limited scopes than the other whole-building programs. As a result, rather than offering a graduated incentive that increases with energy savings, Bay REN will offer a flat incentive to building owners who install two or more measures the program anticipates will achieve a minimum of 8% energy savings.[76] As discussed further below, Bay REN also seeks to facilitate the upgrade process by eliminating the need for a comprehensive building audit. Because PG&E serves much of Bay REN's territory, buildings owners interested in larger upgrades may pursue PG&E's EUC MF Path offering.

SoCal REN's service territory largely overlaps with SCE and SCG service territories, but SoCal REN's multifamily offering takes a similar approach to that of SCE and SCG. In Decision 12-11-015, the Commission acknowledged this similarity, but approved the program for piloting. The decision states that the difficulty of reaching the multifamily market justifies testing all approaches that may deliver significant energy savings.

Eligible Measures

While other measures are available, Table 60 lists the measures most commonly installed through the comparison programs. Consistent with their performance-based incentives, the whole-building programs offer a wide range of measures, and since the programs are new to the market in their current form, information on the measures most commonly installed is not yet available.

Table 60. Typical Measures Installed by Program

Program	Typical Measures Installed
ESA Program	In-unit weatherization and water saving measures. Includes air sealing, refrigerators, and CFLs.
CSD programs	In-unit weatherization and water saving measures. Includes air sealing, refrigerators, and CFLs.[1,2]
MFEER	Lighting and water saving measures.
Whole building programs	Any combination of measures that results in 10-20% savings

1. Under ARRA, the CSD treated 43 large multifamily buildings and 4 garden-style apartment complexes including common area measures and whole-building weatherization.
2. While ESA and CSD broadly offer the same types of measures, CSD offers a wider range of measures than ESA in certain measure categories.

[76] Bay REN will determine which combinations of measures are likely to meet the 8% energy savings threshold for each participating building based on utility bill information and building characteristics entered into an online tool (see Assessment/Audit section below). Any measure that can be modeled in EnergyPro software is potentially eligible to receive program incentives.

Within each program there are a range of measures that can be installed under certain circumstances. A brief description of measures installed under each program is provided below.

ESA Program Measures

Because the ESA Program's focus is on assisting low-income residents with their utility bills, the ESA Program covers only in-unit measures that directly affect a resident's energy costs. Common area measures such as hallway lighting or central systems like boilers do not qualify for ESA Program funds. Table 61 summarizes the measure types that the ESA Program provides; a complete list of the specific measures in each category is included in Appendix H. Some measures are eligible for installation through the ESA Program only in certain climate zones.

Table 61. ESA Program Measure Types By Spending and Energy Savings[1]

Measure Type	Spending		kWh Savings		Therm Savings	
	Spending	Percent of Total	Savings	Percent of Total	Savings	Percent of Total
Infiltration & Space Conditioning[2]	$86,894,754	44%	6,274,889	10%	974,018	39%
Lighting Measures	$28,056,084	14%	27,483,070	42%	-	0%
Refrigerators	$19,684,296	10%	17,327,150	26%	-	0%
Cooling Measures[2]	$19,415,333	10%	8,919,454	14%	-	0%
Heating Systems[2]	$19,694,389	10%	-	0%	73,081	3%
Water Heating Measures	$15,464,712	8%	595,863	1%	1,251,824	50%
High Efficiency Clothes Washers	$5,036,434	3%	45,673	0%	203,349	8%
Pool Pumps	$1,311,649	1%	2,080,524	3%	-	0%
Microwaves	$535,797	0%	2,900,496	4%	17,206	1%
Total	**$196,093,448[3]**	**100%**	**65,627,119**	**100%**	**2,519,478**	**100%**

1. Data aggregated from PG&E, SCE, SCG, and SDG&E ESA Program PY 2012 Annual Reports. Figures include both multifamily and single family installations.
2. Some measures in category available only in select climate zones.
3. Spending on measures only – does not include spending on customer enrollment.

The majority of the ESA Program's spending goes to infiltration and space conditioning measures, a category that includes envelope and air sealing measures, duct testing and sealing, and attic insulation. However, the figures in Table 61 include both single family and multifamily units; ESA's spending distribution may differ for multifamily units, which often do not have attics available for insulation and may have fewer exterior walls. Lighting measures and refrigerators provide the majority of the ESA Program's electric energy savings, while water heating measures and infiltration and space conditioning provide the greatest portion of therm savings.

For a dwelling unit to receive services, ESA Program contractors must determine that it is feasible to install at least three program measures ***or*** to achieve annual energy savings of at least 125 kWh or

25 therms within that unit through installation of one or two measures.[77] These eligibility requirements apply to both single-family and multifamily residences, which can limit the number of multifamily residences treated because fewer ESA Program measures are typically feasible to install in multifamily units.

CSD Programs

CSD installs some measures that ESA does not offer, primarily a wider range of building envelope measures than ESA, including measures designed to reduce energy loss through windows like tinted window films, shutters and storm windows. CSD also provides repair and replacement of heating and cooling systems and water heaters in both renter-occupied and owner-occupied units.[78]

CSD programs are delivered by designated community action agencies in each county that install weatherization measures at no cost to the resident. The most common types of measures installed are: air sealing and repairing holes or cracks around windows, doors, and pipes; insulation in attics, walls, and floors; fixing or replacing broken windows; insulation blankets on hot water heaters; and ensuring existing heating and cooling equipment are operating properly.

As noted above, the ARRA funding from 2009-2012 allowed CSD to expand its scope for multifamily buildings and address things like building shells, centralized mechanical systems, and common area lighting. Now that ARRA funding has been exhausted, and DOE WAP and LIHEAP funds are smaller than previous years' funding, CSD staff report it is harder to justify spending a considerable portion of the program budget on one building. Therefore, it is less likely that the CSD program funds will be used for common area building measures in coming years.

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[77] Appendix C: California Statewide ESA Program Policy and Procedures Manual. Downloaded from https://www.pge.com/regulation/LowIncomeProgramPY12-14/Pleadings/Joint-CDE/2013/LowIncomeProgramPY12-14_Plea_Joint-CDE_20130715_281462.pdf (Accessed on 8/14/13)

[78] Because building owners are required to provide tenants with working heat and hot water, ESA only provides these services in owner-occupied units.

MFEER Measures

MFEER provides prescriptive incentives for measures across all aspects of a building. Incentives are available for efficient HVAC, building shell, hot water, appliances, lighting, and pool pump upgrades. However, lighting makes up the majority of the measures for which MFEER provides incentives, and provides the largest part of the program's energy savings.[79]

There is variation among utilities in terms of the percentage of projects that receive each type of measure. According to the 2013 process evaluations of MFEER in SCE and PG&E territories, in 2011, SCE's MFEER program was almost exclusively a lighting program with 99.8% of all measures and 98.3% of program energy savings resulting from lighting upgrades.[80] PG&E's and SDG&E's MFEER programs are less lighting-centric with lighting making up about 64% and 69% respectively of program measures. Table 62 provides an overview of the percentage of measure types installed by each program. Because SCE provides electric service only and SCG provides only gas, some measures are not applicable, or less applicable, to those utilities. For example, SCG does not provide any installation of lighting and SCE provides few HVAC measures.

Table 62. MFEER Measures Installed by Utility, 2011

	PG&E[1]	SCE[1]	SDG&E[2]	SCG[3]
Lighting	64%	99.8%	69%	--
HVAC	1.2%	0.01%	--	1%
Appliances[4]	15.8%	0.16%	1%	30%
Water Heat	10.8%	--	27%	45%
Building Shell	7.1%	0.02%	3%	2%
Other[5]	1.2%	--	--	23%

1. 2010-2012 PG&E and SCE Multifamily Energy Efficiency Rebate Program (MFEER) Process Evaluation and Market Characterization Study. April 22, 2013. Available on CALMAC, Study ID PGE0301.01
2. SDG&E 2010-2011 Residential Program Process Evaluation. March 30, 2012 Available on CALMAC, Study ID SDG0257.01. Total exceeds 100% due to rounding.
3. SCG 2010-2011 Residential Program Process Evaluation. March 30, 2013. Available on CALMAC, Study ID 0214.01
4. Appliances include clothes washers and vending machines
5. Pump demand controls and pool heaters

[79] According to the process evaluation of SCE and PG&E's MFEER program for 2010-2012, the prevalence of lighting among MFEER measure installations in SCE territory is a result of steps SCE took to improve contractor performance. In 2011, SCE issued a competitive RFP to select a limited number of contractors to represent the program. All seven of the contractors selected through the RFP process were lighting contractors. Reasons for the prevalence of lighting measures in PG&E and SDG&E territories are less clear, although program incentives often cover the full cost of lighting retrofits in both territories.

[80] The Cadmus Group Inc. 2010-2012 MFEER Process Evaluation in SCE and PG&E Territories, April 15, 2013. Accessed 8/5/13 http://www.calmac.org/publications/MFEER_Process_Evaluation_FINAL_130415.pdf

Building owners rarely use MFEER incentives for upgrade projects that result in deep savings, such as HVAC or building shell upgrades. None of the IOUs reported more than 3% of their measures were HVAC related, and only PG&E reported installing building shell upgrades that represented over 5% of their program measures. PG&E reported that less than 2% of program savings resulted from shell measures and less than 1% of savings resulted from HVAC upgrades. In SCE, there were almost no HVAC or building envelope upgrades (.03% of measures installed and .03% of all program savings).

EUC Measures

Because their incentives are based on modeled energy savings that reflect existing building conditions, the Multifamily EUC programs allow for a wide range of measures. A list of potential upgrade measures, taken from EUC Multifamily Path PIPs, is in Appendix H. With some exceptions, building owners can install any permanently installed measure for which program-approved energy modeling software can provide savings estimates. Measures not included in Multifamily EUC include solar photovoltaic, solar thermal, cold water savings measures, and clothes dryers.

Outreach Efforts

Each program conducts outreach using different methods. The ESA Program and MFEER rely heavily on program contractors to contact potential participants and "sell" the program. EUC MF relies on utility account representatives and contacts the regional energy networks developed with multifamily property owners to promote the program.[81] The CSD programs rely on the community based service providers to conduct outreach to potentially eligible households.

Details on the outreach strategy of each program are provided below.

ESA Program Outreach

According to a process evaluation for the 2009-2010 LIEE program,[82] the IOUs employed a variety of outreach tactics to encourage enrollment in the program.[83] Common approaches included outbound calling and/or automated voice message campaigns, email, direct mail, canvassing, and working with municipalities to host or attend community events in areas with low-income populations. All of the utilities have tried various forms of mass media, such as TV and advertisements on public transportation and campaigns targeted at specific populations.[84] Mass media outreach is viewed as an effective way to generate awareness and credibility so that when the customer next encounters the program – whether

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[81] For more information, refer to the "what is asked of the participant" section of the memo.

[82] LIEE (or the Low-income Energy Efficiency Program) was the name for the ESA Program prior to 2010.

[83] Research Into Action Inc. Low-Income Energy Efficiency Program Evaluation 2009-2010 Process Evaluation, June 10, 2011. Study ID PGE0298.01. Prepared for CA Public Utilities Commission. http://www.calmac.org/publications/LIEEFinal_Report_w_study_number.pdf (Accessed 8/7/13).

[84] For example, SCE and SCG participated in a Univision telethon, PG&E provides language services for the Hmong population, and SDG&E's has a Hispanic radio station campaign.

through outbound calling, a mailer, or someone knocking on their door – they will be more receptive to enrolling.

In 2009-2010, some differences existed in terms of how much emphasis each IOU put into specific outreach efforts. For example, SCE, SCG, and SDG&E provided marketing materials to contractors while PG&E encouraged contractors to create their own materials in addition to materials provided. All of the IOUs also provided lists of leads to contractors.[85] Another difference between IOUs was in how much canvassing contractors were expected to conduct. PG&E contractors did more door-to-door canvassing of the program than did contractors at the other utilities.

Decision 08-11-031, issued in November 2008, directed the IOUs to undertake a Whole Neighborhood Approach (WNA) outreach strategy for the ESA Program. The WNA strategy sought to leverage economies of scale to increase the efficiency of program delivery by enrolling large numbers of participants in the same area at once and delivering retrofits to them at the same time. In a subsequent white paper, the Commission's Energy Division described the WNA process:[86]

1. The IOUs identify a neighborhood for targeted the ESA Program outreach based on the proportion of low-income individuals in the neighborhood and/or higher than average energy usage in the neighborhood.
2. The IOUs then conduct outreach to neighborhood residents, including canvassing, direct mail, email blasts, and potentially attendance at community events.
3. ESA Program enrollment and assessment contractors conduct assessments of interested households in the neighborhood, with installation contractors closely following the assessors to install basic weatherization, hot water saving, and lighting measures.
4. When needed, installation contractors return to install more complex heating and cooling measures and replace appliances or equipment.
5. The IOUs follow the ESA Program's typical quality assurance and control processes for the retrofitted units and follow-up with interested residents in the neighborhood not reached in the initial sweep.

According to the 2009-2010 LIEE process evaluation, the IOUs largely found the WNA strategy as described above impractical. It was difficult to recruit a large enough group of participants in a relatively small area to allow installers to take advantage of economies of scale. Many potential participants were not home to speak with enrollment contractors or were not prepared to provide income documentation. In addition, the diversity of single-family homes made it difficult for installers to predict what equipment they would need.

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[85] The leads include information on location, CARE participation, and customers that participated in ESA in recent years.

[86] California Public Utilities Commission Energy Division. Draft Whole Neighborhood Approach – White Paper. May 2009.

In some cases, the program was able to overcome these challenges in large multifamily properties. Large multifamily properties offered a large enough pool of potential participants that, even if many were not home or could not provide income documentation, enough participants were available and qualified that installers could still take advantage of economies of scale. In addition, the units within a development offered uniform enough efficiency opportunities that contractors could anticipate their equipment needs in advance.

Although the IOUs achieved some success implementing a WNA strategy for the ESA Program in multifamily buildings, one ESA Program staff member said these multifamily WNA efforts required a great deal of coordination and were very labor intensive as a result. Due to the amount of labor required, this staff member stated that it would not be practical to include this type of WNA outreach in ongoing ESA Program operations.

While the IOUs found the WNA strategy described in the 2009 white paper impractical, they have taken steps to improve the efficiency of ESA Program delivery by targeting small geographic areas. The IOUs target their outreach efforts for the ESA Program to focus on areas with high concentrations of low-income residents. In addition, ESA Program workload management software groups' jobs by geographic area, allowing contractors to minimize time spent traveling from one job to another.

CSD Programs

Weatherization services are delivered by 40 designated local community action agencies operating in each California County. These local agencies provide a variety of poverty relief services which may include: subsidized child care, emergency food services, and economic development opportunities. Weatherization and energy-efficiency services are often one service among many these agencies offer to residents of their counties. Through their contact with low-income households across these different services, the programs are able to refer households to weatherization services.

In some areas of the state the contractors that install weatherization measures for CSD also install measures for the ESA Program. In these cases, coordination across programs can happen more easily because the same people are involved in both programs. In other areas of the state the contractors for the two programs are different and coordination across programs happens, but is minimal. According to utility staff interviews, ESA Program staffs are most likely to refer potential participants to the local community action agency when participants use propane for space and water heating. In units with propane, the electric IOU-sponsored ESA Programs can only provide lighting, refrigerators, and cooling measures, so participants can receive air sealing and other measures through CSD's program. Because

there are very few multifamily buildings in California served by propane, coordination across programs likely does not happen often in the context of a multifamily building.[87]

Given the limited funds CSD has to complete upgrades in 2013 compared to 2012, the program may not need to conduct significant outreach efforts beyond referrals in order to recruit as many participants as it will have the capacity to serve.

MFEER Outreach

MFEER is primarily delivered by trade allies—contractors who use the program's incentives to sell energy-efficient retrofits to customers—but, in some cases, the IOUs have become more involved in marketing MFEER in recent years. According to the PG&E and SCE MFEER process evaluation covering program years 2010-2012, utility representatives were the most common source of program awareness for participants (31% of SCE participants and 27% of PG&E participants), followed by contractors (30% of SCE participants and15% PG&E participants).[88] Other sources of program awareness include word of mouth, seeing an advertisement, and the utility website.

The process evaluation also asked participants to describe what motivated participation. More respondents reported saving energy was an important motivation for participation than any other motivation (91% percent of PG&E participants and 95% of SCE participants) but this was followed closely by the over 85% of respondents that reported they wanted to demonstrate that their properties were well maintained and that 85% wanted to do the right thing for the environment. Other reasons given for participation included reducing tenant utility costs, reducing owner operating costs, and increasing the value of the property.[89]

Whole Building Program Outreach

The IOUs have not conducted large-scale outreach efforts for the EUC Multifamily Path due to the limited budgets and modest goals of these newly launched programs. As described in the "What is asked of the participant" section below, the IOU EUC MF programs will use a single point of contact to direct multifamily building owners to the programs most appropriate to their upgrade plans. While the single point of contact will work with participants in all of the multifamily programs, the role is most closely associated with EUC MF Path, and will likely work most extensively with EUC MF Path participants. At SCE and SCG, the building owners' utility account managers are expected to fulfill the role of the single

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87 According to the 2011 American Housing Survey, there are 6,500 multifamily units served by propane (bottled gas) in the metro areas of San Diego, Los Angeles, San Francisco and San Jose. Assuming 25 units per building means there are 260 buildings served by propane. Assuming 100 units per building means there are only 65 buildings served by propane.

88 The Cadmus Group Inc. 2010-2012 MFEER Process Evaluation, April 15, 2013.

89 The Cadmus Group Inc. 2010-2012 MFEER Process Evaluation in SCE and PG&E Territories, April 15, 2013. Accessed 8/5/13 http://www.calmac.org/publications/MFEER_Process_Evaluation_FINAL_130415.pdf

point of contact, and will thus be able to build on their existing relationships to inform potential participants about the program.

The REN programs will leverage the existing relationships between local governments and multifamily building owners. For example, Bay REN's Program Implementation Plan (PIP) notes that building owners planning renovation projects will come into contact with local governments as they apply for building permits and seek public financing.

Eligibility

Beyond a multifamily property being located in the program service territory, program eligibility is determined by two factors: the income of the participant (or the overall income make-up of the participant's building) and the building type. Income of the participant determines the eligibility of ESA and CSD Program participants and the building type, whether it is a multifamily building or not, determines the eligibility of MFEER and EUC participants.

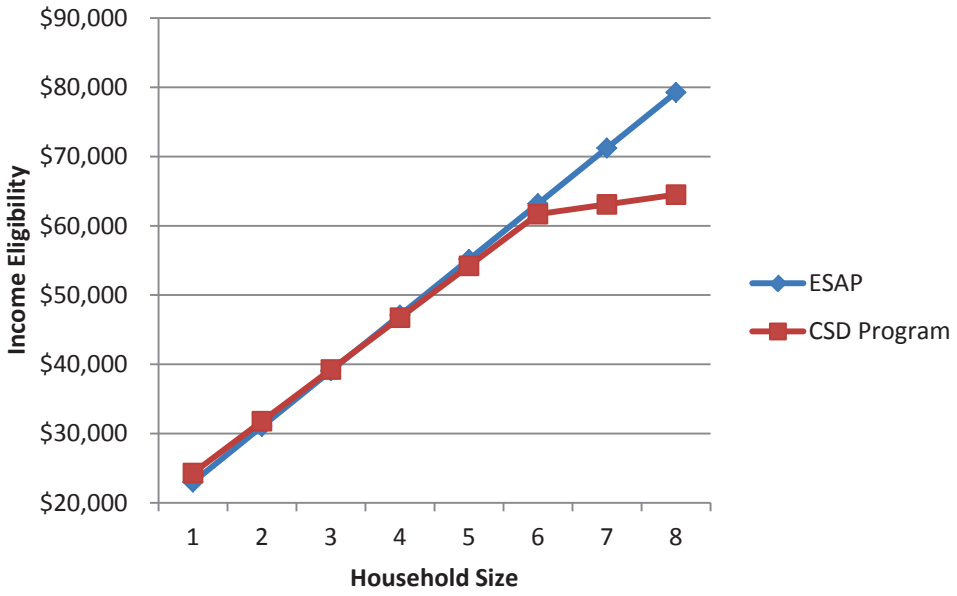
Income Eligibility

The ESA and CSD Programs determine eligibility based on the income of a household relative to the size of the household. As indicated in Figure 53, the income levels for eligibility are similar between the ESA Program and the CSD Program but not the same. The ESA Program's eligibility requirements are based on 200% of Federal Poverty Guidelines, while WAP eligibility requirements are based on 60% of state median income. Larger households, those with seven or eight household members, have higher income levels for the ESA Program than the CSD program meaning more large households may qualify for the ESA Program than for the CSD Program. It is also important to note that the IOUs' Moderate Income Direct Install (MIDI) program is available to households earning up to 250% of the Federal Poverty Guideline in SCE and SCG territory and 300% of Federal Poverty Guideline in SDG&E territory. MIDI offers many of the same services as the ESA Program and is delivered by the same contractors.

The CSD program's eligibility criteria allow the program to treat all of the units within a building if 66% of the building's units are income qualified.[90] The ESA Program must meet a higher threshold, determining that 80% of the units are occupied by income-qualified tenants, before treating all units in the building.

[90] Department of Energy. Weatherization Program Notice 09-1, Effective Date November 17, 2008. http://waptac.org/data/files/website_docs/government/guidance/2009/wpn%2009-1%20-%20final%2011.17.08.pdf (Accessed August 15, 2013)

Figure 53: Annual Income Eligibility



Income included in the ESA Program household calculation includes wages, salaries, and benefits from public assistance such as food stamps and housing subsidies.[91] ESA Program accepts enrollment in certain other income-qualified programs as sufficient verification of a tenant's income qualification. For example, a resident of a multifamily building can participate in the program by providing documentation that they are participating in programs such as food stamps.[92]

Building Eligibility

The only determination to participate in MFEER and EUC Multifamily is for the building to be a multifamily property. There are no income requirements for either MFEER or EUC; however the majority of the participants in the ARRA-funded EUC Multifamily pilots in Alameda, Los Angeles, and San Diego counties were properties offering affordable housing.

MFEER defines multifamily as any residential property with two or more units. Additionally, the common areas of condominiums and mobile home parks can qualify for the program. MF EUC programs require

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91 For a complete list of items included in income, see the Policy and Procedures Manual. Appendix C: California Statewide ESA Program Policy and Procedures Manual. Downloaded from https://www.pge.com/regulation/LowIncomeProgramPY12-14/Pleadings/Joint-CDE/2013/LowIncomeProgramPY12-14_Plea_Joint-CDE_20130715_281462.pdf (Accessed on 8/14/13)

92 The Policy and Procedures Manual for the ESA Program lists all forms of acceptable income verification. Appendix C: California Statewide ESA Program Policy and Procedures Manual. Downloaded from https://www.pge.com/regulation/LowIncomeProgramPY12-14/Pleadings/Joint-CDE/2013/LowIncomeProgramPY12-14_Plea_Joint-CDE_20130715_281462.pdf (Accessed on 8/14/13)

participating buildings to have five or more units (the same criteria that the ESA Program uses), although SCE and SCG's program will accept buildings with as few as three units but will not accept buildings over four stories tall.

Incentive Structures

The simplicity or complexity of incentives corresponds with the nature of the programs. For example, the ESA Program and MFEER typically provide relatively simple measures, whereas the EUC programs provide their incentives based on meeting a performance goal (Table 63). In the case of the ESA Program and the CSD Program, participants receive measures for free with the programs incurring the cost of all measures and installation. MFEER's prescriptive incentives generally cover the full cost of lighting upgrades and water saving measures. MFEER incentives offset the cost of building shell, appliances, or HVAC measures, with participating building owners responsible for the portion of the retrofit cost not covered by the rebate. Recall from the eligible measures section that most MFEER projects are lighting and water savings related, thus making most MFEER projects free to the building owner.

Table 63. Incentive Summary by Program

Program	Direct Install	Prescriptive	Custom/ Performance	Installed Primarily in		Rebates Provided
				Units	Commons	
ESA Program	✓			✓		100% of project cost covered
CSD (WAP/LIHEAP)	✓[1]			✓		100% of project cost covered
MFEER	✓	✓		✓	✓	100% of project cost covered for lighting and water saving measures; Rebates offset cost of other measures[2]
EUC[2]			✓	✓	✓	Rebates offset the cost of installed measures and vary by EUC program[3]

1. Like programs offering custom incentives, CSD service providers may use energy performance modeling to determine measure cost-effectiveness, particularly when completing whole-building weatherization in large multifamily buildings. However, CSD is considered a direct install program because it selects the contractors who will install measures and fully subsidizes retrofits of all cost-effective measures.
2. Recall that lighting is the dominant measure associated with MFEER. The SDG&E MFEER process evaluation indicates that their rebates also make the water saving measures free for participants.
3. More specific information on the EUC incentives are provided below

EUC's incentives generally do not cover 100% of the upgrade cost and incentives vary across the various administrators of EUC. The next section details the incentives offered by EUC.

Incentive Structures within Whole Building Programs

The incentive levels listed in SCE and SCG's PIP are somewhat higher than those offered by SDG&E. SDG&E anticipates that $100 of its per-unit incentive will cover the cost of energy modeling and combustion safety testing, while SCE and SCG provide audits and energy modeling at no cost to the participant. As a result, SCE and SCG will likely contribute more to participants' upgrade costs than SDG&E. Of the three MF EUC programs that specified graduated incentive levels, SoCal REN's performance-based incentives are the lowest, but SoCal REN offers relatively large incentives to cover the cost of energy audits. PG&E's PIP does not specify incentive levels for specific savings proportions; instead, PG&E will refine its incentive structure based on initial upgrades and additional analysis. Nonetheless, PG&E anticipates that it will provide MF EUC participants with an average incentive of $1,000 per unit.

In order to provide a basis for comparison of overall incentive levels, Table 64 lists the MF EUC incentives under each program available to a 50-unit building achieving 20% energy savings.

Table 64. Whole Building Incentives for a 50-unit Building Achieving 20% Energy Savings

Program Administrator	Audit Incentive	Improvement Incentive	Total
SCE/SCG	Fully subsidized	$50,000	$50,000 + value of audit
PG&E	$5,000	$50,000 (estimate)	$55,000 (estimate)
SoCal REN	$10,000	$35,000	$45,000
SDG&E	Included in improvement incentive	$40,000	$40,000
Bay REN	N/A	$37,500	$37,500

As noted above, Bay REN's multifamily whole-building offering targets building owners interested in smaller upgrades than the IOUs' EUC MF Path programs or SoCal REN's program. Bay REN's incentive offerings do not offer graduated incentives for building owners that achieve higher levels of energy savings. Instead, building owners receive a set per-unit incentive for installing two or more measures that the program anticipates will provide energy savings of at least 8%.

The program designers hope that upgrade projects will average 12% savings. As a result, PG&E's MF EUC program may be more appropriate for buildings undertaking retrofits that achieve higher levels of energy savings, like the example in Table 64.

Assessment/Audit

Each program provides some type of review of the participant's building, whether the participants is the owner or resident. In the case of the ESA Program, individual units treated under the CSD Program, and MFEER, relatively basic assessments are provided.[93] For the ESA Program this review is limited to the units where tenants have qualified to receive program services. The CSD program review can potentially go beyond in-unit assessments to include common areas and centralized mechanical systems but as mentioned earlier, due to limited funds, common area measures are less likely to be installed going forward than they were when ARRA was supporting weatherization services. Contractors using the MFEER program may conduct a broader assessment, including common areas and central systems.

A contractor or staff person reviews the building (or units) and determines which measures are applicable to the property based on this walk-through assessment. For the ESA Program, this assessment determines whether the unit is likely to meet the program's requirement to install at least three measures per unit or meet deemed savings requirements of 125 kWh or 25 therms annually.

Energy modeling is not required of the ESA Program, individual units treated under the CSD Program, or the MFEER Program (Table 65) but it is required of EUC programs. The next section describes the assessment and audit process associated with EUC programs.

Table 65. Assessments and Audits by Program

Program	Assessment	Audit	Assessment/Audit Provider
ESA Program	Free walk through assessment	Not provided	Program contractor
CSD (WAP/LIHEAP)	Free walk through assessment	Not provided for individual unit upgrades; Comprehensive audit required for buildings receiving common area or central system improvements	Program staff perform walk through assessments; professional energy consultants perform comprehensive audits
MFEER	Free walk through assessment	Not provided	Program contractor
EUC	Free walk through assessment	Up to and including an Investment Grade Audit (IGA) provided	Rater/Analyst

Assessment/Audits Specific to Whole Building Programs

According to EUC MF Path and REN PIPs, SCE, SCG, SoCal REN, and PG&E program staff will conduct preliminary walk-through assessments of buildings whose owners have expressed interest in MF EUC. These assessments identify energy upgrades likely to meet the program's savings requirements. If staffs conclude that the potential for whole-building energy upgrades exists, the building will undergo a more comprehensive audit.

[93] In multifamily buildings receiving whole-building weatherization, the CSD program requires a more in-depth audit conducted by a qualified energy auditor.

All of the Whole Building Programs with the exception of Bay REN include comprehensive audits. The programs vary, however, in the way these audits are provided. In PG&E, SoCal REN, and SDG&E's programs, building owners select and contract directly with a participating HERS rater to conduct the audit. SDG&E does not subsidize audits directly; its per-unit incentive levels include $100 to cover the cost of the combustion safety testing and energy modeling included in the audit. SoCal REN and PG&E will offer incentives based on building size to cover the cost of the audit, with PG&E offering larger incentives to buildings providing affordable housing. SCE and SCG will take a different approach, contracting with an energy consulting firm whose staff members will conduct audits at no charge to participants.

In an effort to reduce costs and streamline the retrofit process for participants, Bay REN's program seeks to eliminate the need for a comprehensive, on-site audit. Instead, the program plans to modify EnergyPro energy modeling software to create a tool that will generate energy saving projections based on inputs that a building owner could collect on their own. This tool would provide a "minimum assumed savings" estimate that the program would use to determine whether a building owner's proposed upgrades are likely to meet the program's minimum savings requirement. The program's technical advisors conduct a site visit to verify the building conditions entered into the software tool and ensure that the proposed measures are appropriate.

What is asked of the Participant

As mentioned previously, ESA Program and CSD Program participants are building residents and MFEER and EUC participants are building owners. In the cases of the ESA Program and the CSD Program, owners must get involved even though they are not the participants because they must grant access to the property and approve measure installations. CSD staff noted that some building owners are also motivated to participate in the retrofit process because they recognize the benefits to their tenants. Table 66 summarizes the requirements of the owner and the residents for each program.

Table 66. Requirements of Participant Summary

Program	Requirements of Building Owner	Requirements of Building Resident
ESA Program	No requirement other than granting permission to property by signing waiver	Apply to program, verify their income; allow enrollment and installation contractors and QC inspectors access to unit; receive free upgrades
CSD (WAP/LIHEAP)	Grant permission to property and may provide income qualification and demographic data, and information about building performance. Coordinate with program on scope and installation of central system, common area, and building shell measures, if applicable.	Apply to program, verify their income; allow installation contractors access to unit; receive free upgrades

Program	Requirements of Building Owner	Requirements of Building Resident
MFEER	Apply to program; Work with contractor to install equipment; Submit receipts to utility for rebate; Pay little or none of the project cost	No requirements
EUC	Work with "single point of contact" from EUC throughout project process; contract with rater/analyst; schedule time for rate/analyst to review building; coordinate times for installations to occur; pay majority of upgrade cost	No requirements

The ESA Program and the CSD Program require little investment on the part of participating residents beyond completing an application, verifying their eligibility, and scheduling time for the program contractors to do assessments, installations, and inspections. Similarly, MFEER incentives often cover the full cost of retrofits for participating building representatives. In contrast, whole-building programs provide comprehensive upgrades that require a significantly larger investment on the part of the participating building representatives. In whole-building programs participating building representatives must agree to pay a larger share of the project cost than the other programs and be more involved in the coordination of installation and inspection activities occurring at his/her property.

Multifamily and the "Single Point of Contact"

Responding to Commission direction in D. 12-11-015, in 2013, all of the IOUs planned to implement a single point of contact for multifamily building owners. This single point of contact will primarily work with building owners to determine which efficiency program offerings are most appropriate given the characteristics of the building and the types of upgrades the owner is interested in undertaking. In addition to identifying programs, the single point of contact will assist building owners in navigating program participation processes and coordinating processes across programs. For example, the implementer of a pilot using a single point of contact approach in SDG&E territory was able to schedule QC inspections concurrently with the HERS rater's visits to minimize disruption to building owners and tenants.

In SDG&E's Multifamily EUC pilot, the single point of contact approach proved effective in leveraging ESA Program services for buildings undertaking large retrofits, but it was less common for building owners who initially came into contact with ESA Program or MFEER to then pursue EUC. One implementation staff member involved in SDG&E's Multifamily EUC pilot stated, "That collaboration is going from EUC down, not from the ESA Program up, if you think of ESA as the first rung on the ladder."

The IOUs single point of contact is designed to assist building owners in identifying programs and navigating the participation process. The single point of contact does not provide participants with technical assistance in identifying and evaluating upgrade opportunities and managing measure installation. Instead, the whole-building programs, with the exception of Bay REN, require participating

building owners to contract with HERS raters and BPI Multifamily Building Analysts to provide this type of support. The programs maintain a list of qualified raters and analysts, and building representatives select and contract with a qualified rater directly. Raters conduct audits and energy modeling, work with building owners to develop a scope of work for their energy upgrade projects, verify that upgrades are installed properly, and conduct a post-installation audit.

Bay REN and SoCal REN will also provide building owners participating in their whole-building programs with assistance throughout the upgrade process, although PIPs suggest that this assistance will be more focused on the technical aspects of completing upgrades than on identifying and navigating program processes. Bay REN may refer participants to PG&E's single point of contact if program staffs determine that the participant might be better served by a utility program.

All of the MF EUC programs allow participants to select the contractor that will install retrofit measures, although PG&E requires that participants use a contractor that is enrolled in EUC and has attended a pilot information session.

Coordination Between Programs

Together, the programs serving low-income multifamily buildings and their tenants in California address a broad spectrum of efficiency needs and provide a variety of offerings for building owners interested in upgrades ranging from relatively small-scale weatherization to major retrofits. However, none of the individual programs provides this full range of services. Instead, coordination between programs is necessary to meet the policy goal of addressing all of the efficiency needs within multifamily buildings. Coordination between utilities is also necessary, particularly in relation to customer served by more than one IOU. As single fuel utilities that share many customers, SCE and SCG in particular have taken steps to coordinate across their different customer data systems.

The following sections describe how the ESA Program coordinates with other energy-efficiency programs targeting low-income multifamily buildings and their tenants. In the past, the IOUs have faced challenges in effectively coordinating between the ESA Program and other efficiency programs serving the multifamily market, and coordination has been somewhat limited. However, plans for MF EUC programs describe a more formal coordination process, and the single point of contact is expected to work with participants in all of the programs targeting multifamily buildings to identify any additional program opportunities.

The CSD Program

While there is overlap in the measures installed between the ESA Program and the CSD Program, some participants, particularly those with non-IOU-provided heating fuels, may qualify for measures under the CSD Program that they are not eligible for under the ESA Program. However, coordination between the ESA Program and the CSD Program has been limited. The 2009-2010 LIEE Process Evaluation reported that LIEE enrollment and assessment contractors mentioned the CSD program to LIEE recipients in 23% of the visits evaluators observed.[94] IOU program staff cited two factors that prevent greater coordination between the ESA Program and the CSD Program: The CSD program typically has a much smaller budget than the ESA Program, making it difficult to devote resources to coordination efforts, and the CSD program has a more fragmented delivery structure, with local community action agencies delivering the program to participants in their counties.

The CSD Program's limited budget in comparison to the ESA Program has restricted coordination between the programs because ESA Program staffs are reluctant to refer more customers to the CSD program than the program has the capacity to serve. As a result, ESA Program staffs typically refer only the customers with the greatest need. The CSD Program's limited capacity to accept referrals from the ESA Program will likely continue.

The CSD program is delivered by 40 community action agencies throughout 58 counties across California. According to IOU staff, this fragmented delivery structure has limited the potential for information-sharing between the ESA Program and the CSD Program. ESA Program staffs see a potential to leverage the CSD program's information, including which households had participated and what measures had been installed. CSD, the IOUs, and the Commission are currently collaborating on a pilot to improve data sharing between programs. One obstacle the programs have faced in the past is customer confidentiality issues, which must be worked out before data-sharing can be implemented on a large scale.

In order to address some of the coordination obstacles between the ESA Program and CSD, in 2009 the Commission and CSD entered into a memorandum of understanding (MOU) that outlined their intent to "leverage and coordinate existing programs for low-income energy efficiency and utility assistance." [95] The coordination did not happen immediately because CSD became busy administering the large infusion of ARRA money they received and utilities became busy developing the EUC programs. Over the last year, CSD and utilities have started to launch pilot programs aimed at improving their coordination. These pilots will focus on data sharing, opportunities for geographic coordination and leveraging, solar hot water system installation, and bulk purchasing.

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[94] In 23% of the project site visits conducted by the ESA Program evaluation team, contractors mentioned the CSD program.

[95] Memorandum of Understanding between the California Public Utilities Commission and the Department of Community Services and Development (CSD), March 17, 2009.

MFEER

Some overlap exists between the measures incentivized through MFEER and the measures ESA Program installs. Since the ESA Program targets low-income households and MFEER targets building owners, coordination between the two programs is necessary to ensure that the measures each program provides do not duplicate measures already installed by the other. Process evaluations of SCG and SDG&E's 2010-2011 multifamily retrofit programs have cited problems caused by a lack of information sharing between the ESA Program and MFEER. IOU program staff described efforts to better carry out this type of coordination, and anticipated that the single point of contact would facilitate coordination between programs. IOU program staff reported closer coordination between ESA and MFEER occurring on some recent projects.

A process evaluation of SDG&E's 2010-2011 multifamily retrofit program reported that in some cases program contractors replace measures installed under a previous program with similar measures; according to the evaluation this is most common with low-cost measures like faucet aerators, showerheads, and lamps. IOU staff noted, however, that since 2010, some IOUs have stopped offering some of these low-cost measures through MFEER. In order to avoid duplication of measures, program staff from multiple IOUs noted that MFEER staff can access the ESA Program database to determine which units in a participating building the ESA Program has served. However, IOU staff noted that it may be difficult to match ESA Program participants to facilities participating in MFEER, particularly in large complexes where units may have different street addresses.

In addition to efforts to avoid duplication of measures, staff at multiple IOUs described efforts to cross-promote the ESA Program and MFEER. For example, MFEER and the ESA Program each promote the other program in their marketing collateral and SCE program staff reported that they are developing a Multifamily Property Energy Efficiency Resource Guide, which will provide building owners with information about all of the energy efficiency and renewable energy programs targeting the multifamily sector. MFEER will also include information on its application form informing building owners about the potential to receive services from the ESA Program. MFEER program staff may also encourage the owners of participating buildings to allow the ESA Program to treat their tenants. ESA Program staffs also provide interested building owners information about MFEER.

Evaluation findings have also detailed challenges with these cross-promotional efforts, however. According to recent process evaluations, SCG and SDG&E's MFEER programs referred any building with households that might qualify for the ESA Program prior to installing measures through MFEER. However, contractors reported that this resulted in delays in MFEER installations as ESA Program verified tenant eligibility and determined which measures it would install. Because of the potential for delays, and resulting contractor dissatisfaction, some IOUs have chosen not to require buildings to receive measures from the ESA Program prior to participating in other multifamily efficiency programs.

MF EUC

Among the programs serving the multifamily sector, the IOUs' plans for MF EUC include the greatest degree of formal coordination with the ESA Program, although these integration efforts occur differently across the state. As part of their agreement to participate in the MF EUC program, SDG&E will require building owners to authorize the ESA Program to serve their income-qualified tenants. ESA Program contractors will then qualify and treat all willing and eligible tenants before the building baseline is calculated. [96] SCE and SCG will not require building owners to authorize ESA to serve their tenants prior to MF EUC participation, although the single point of contact will educate building owners about all of the available efficiency programs, including ESA. SCE program staffs anticipate building owners will recognize that, in most cases, leveraging the ESA program's services will be the most beneficial approach. SCE staff reported that the energy auditors working with their MF EUC program would prefer that ESA measures be installed after the MF EUC modeled energy savings estimates had been confirmed.

While IOU staff noted that drawing on ESA prior to making larger efficiency improvements had been successful in a pilot project conducted at a subsidized housing development, they expressed some concern that it may be less feasible in multifamily developments where only a small portion of residents are low-income. In addition, a contact involved in the implementation of the MF EUC pilot in San Diego noted that following all of the policies and procedures of each program treating a building can result in building owners receiving numerous visits from program staff. This contact noted that coordinating these visits in order to minimize the disruption to the participant can require a great deal of effort. IOU staffs anticipate that coordination between ESA and MF EUC will be streamlined as the IOUs learn from early efforts to integrate program offerings and develop additional resources like the single point of contact and a greater capacity to support whole-building energy audits.

[96] In the case of a very large scale rehabilitation in which any measures ESA installed would be removed over the course of the project, ESA may address any measures remaining to install after other retrofits are complete.

Section 7. Financing and Funding Options

In coordination with the ESA Program Multifamily Study Team, Cadmus researched financing and funding options available to multifamily property owners making energy-efficiency capital improvements, especially for properties with a high proportion of ESA Program-eligible tenants. This research was not intended to be limited to debt options, but to look at a range of potential funding sources to support energy-efficient upgrades, including grants and tax incentives. To that end, "financing" in this section does not refer specifically to loans, but to any program the helps owners pay for an energy saving project.

Appendix I provides additional detail for the 16 financial and funding options reviewed in this section.

Limitations of the Financing Catalog

The multifamily funding landscape is constantly changing and new financing programs continue to emerge. This catalog presents a sample of representative programs and resources; it should not be regarded as an exhaustive list. Furthermore the catalog does not include programs offering nonfinancial support to energy-efficiency and renewable energy projects (such as permit expediting, although a reduced permit wait time may be financially advantageous in some situations). In addition, data may exist that was not available to our team, such as representative projects and number of projects completed. When interpreting data such as number of projects complete, it is good to note that the programs may not have much activity simply because they are new or because they lack marketing or administrative dollars, and not necessarily because of a failure of program design.

Multifamily Property Owner Financing Catalog: Description and Use

The purpose of the catalog is to give the ESA Program Multifamily Study Team a snapshot of the multifamily financial solutions targeted at energy or environmental related projects, areas in California where the solutions are available, and who or what projects are eligible. We anticipate this catalog will be useful in two ways.

- First, it provides the Study Team with different program design elements that have been developed for the California market, and with which property owners may already have some familiarity. Where information is available, we provide an estimate of the number of projects completed, size of the program, maximum amount of financial support per retrofit project, if the funding supports renewables or energy-efficiency, and other descriptive factors.
- Second, the catalog can help identify where financing gaps exist in the market place. For example, nationwide and statewide programs likely cover all California multifamily buildings, but services that are provided by cities or counties are unlikely to apply beyond their jurisdictions. If the local programs are popular, they could provide models for services the IOUs would like to expand to a broader scale. Or, programs can be combined with ESA Program resources to broaden the scope of buildings that qualify.

The following examples illustrate how the catalog can be used:

- Not all buildings are ready for EE measures to be installed. A program like the **CalHFA Preservation Loan Program** can be used to fix holes in a roof or update plumbing, so that funds targeted to energy efficiency could then be used for conservation measures such as insulation or a high-efficiency water heater.
- The **LIIF Bay Area Multifamily Retrofit Loan Fund (recently discontinued but may be restarting under a different effort)** provides financing for up to 50% of the cost of retrofits that reduce energy use by at least 10%, up to $500,000. While this program is helpful, larger projects may still need additional incentives from other sources. This program is limited to the bay area so buildings in Southern California are unable to take advantage of this resource.

The catalog presents active or recent multifamily building funding and financing opportunities that we anticipate could complement a wide range of ESA Program strategies that adopt a whole-building approach. Programs included in the catalog meet the following criteria:

1. **They can be used for retrofitting existing multifamily housing, whether low-income specific or market-rate housing.**
   Programs must complement ESA Program strategies by providing alternative or complementary financial assistance to property owners of complexes housing ESA-Program-eligible utility customers. To be included in the catalog, a program must provide incentives for retrofitting existing, multifamily housing, regardless of the party eligible to apply for the incentive (tenant or owner). While some programs included in the catalog support new multifamily construction or retrofits to other types of buildings, none do so exclusively.
2. **They promote awareness of building energy costs, green building, renewables, and energy efficiency.**
   All programs and financing products included in the catalog promote green building, energy-efficiency, or renewable energy technologies. Financing programs not specifically requiring attention to building energy usage do not promote awareness of energy conservation or utility cost issues. They may even create a barrier to greater efficiency and conservation by allowing "missed opportunities" to occur. In other words, such programs could allow building retrofits that do not address relevant energy-usage issues, and make it less likely an owner will further invest in energy-saving improvements.
3. **The programs are available in areas served by one or more of the California IOUs.**
   The catalog only includes programs available to property owners with tenants that could be eligible for the ESA Program.

The catalog presents 16 programs currently or recently active in the California IOU's territories. These programs are listed in Table 67.

Table 67. Programs Included in Financing Catalog (August 2013)

Name of Program/Product	Region	Type	Website
Green Finance Plus	United States	Financing	https://www.fanniemae.com/content/fact_sheet/grnrefiplus.pdf
Green Affordable Housing Preservation Loan Fund	United States	Financing	http://www.nhtinc.org/green_loan_fund.php
Rural Development Multifamily Housing Energy Efficiency Initiative	US (Section 516 funds can be used for off-farm housing for farm workers in urban areas. All other projects must be in non-urban areas, which cover most of CA.	Financing and grants	http://www.rurdev.usda.gov/program_details.html
Mark-to-Market (M2M) Green Initiative Pilot	United States	Grant/ Loan Restructuring	http://www.hud.gov/offices/hsg/omhar/paes/green/greenini.pdf
Business Energy Investment Tax Credit	United States	Tax Credit (Federal Corporate Tax)	http://energy.gov/savings/business-energy-investment-tax-credit-itc
CaliforniaFIRST (PACE)	More than 100 cities and counties throughout the state, as well as statewide	Financing	https://californiafirst.org/property_owners_overview
CalHFA Preservation Loan Program	State of California	Financing	http://www.calhfa.ca.gov/multifamily/financing/termsheets/index.htm
Multifamily Portfolio Loan Prepayment Program	State of California	Financing Prepayment	http://www.calhfa.ca.gov/multifamily/financing/termsheets/index.htm
Property Tax Incentive	State of California	Tax Exclusion (State Property Tax)	http://www.boe.ca.gov/proptaxes/gase.htm

Name of Program/Product	Region	Type	Website
Multifamily Affordable Solar Housing (MASH)	State of California	Rebate	http://www.cpuc.ca.gov/PUC/energy/Solar/mash.htm
Bay Area Multifamily Retrofit Loan Fund	San Francisco Bay Area	Financing	http://www.liifund.org/products/community-capital/capital-for-affordable-housing/bay-area-multifamily-fund/
LEED Incentive Program	Burbank, Calif.	Rebates	http://www.burbankwaterandpower.com/incentives-for-businesses/leed-incentive-program
Energy Solutions	Burbank, Calif.	Rebates	http://www.burbankwaterandpower.com/incentives-for-businesses/energy-solutions-business-rebate-programs
Energy Upgrade California Multifamily Program, Bay Area	Bay Area, Calif.	Rebates and free technical assistance	https://multifamily.energyupgradeca.org/local#bayarea
Energy Upgrade California Multifamily Program, Los Angeles County	Los Angeles County, Calif.	Rebates and free technical assistance	https://multifamily.energyupgradeca.org/local#los_angeles
Energy Upgrade California Multifamily Program, Marin (Green Multifamily Loan Program)	Marin County, Calif.	Financing	https://multifamily.energyupgradeca.org/local#marin

Rows follow in the order of geographic coverage, with nationwide programs presented first, followed by statewide programs, and then local and county programs. Within each geographic subsection, the catalog identifies program eligibility and types of measures supported. In addition to the programs identified in Table 67, the IOUs provide financing and rebates for multifamily buildings through On-Bill Financing[97] and the Multifamily Energy Efficiency Rebate program. CPUC D.13-09-044 also authorizes ratepayer funding for two additional financing programs targeted to the multifamily sector in the 2013-2014 program cycle, one administered by the IOUs and another administered by BayREN.

The financing catalog is provided in Appendix I, and Table 68 describes each column header in the catalog.

Table 68. Data Description for Catalog Headers

Column Header	Definition
Name of Program/Product	Name of the funding program, as it is marketed or best known.
Sponsor	The organization that manages the program.
Region	The region covered by the program.
Type	The type of funding product offered by the program.
Targets Low-income?	Indicates whether the program is specifically targeted to low-income or affordable housing.
Program Size	The total amount of funding available for distribution through the program.
Individual Project Amount	The total amount of funding available for any single applicant.
Percent of Project	The percentage of total project costs that the program can cover.
Eligibility	Project or applicant requirements necessary to qualify for funds through the program.
Restrictions on Measures (if applicable)	Any restrictions on measures funded through the program.
Energy-efficiency (EE) or Renewable energy (RE)	Whether the program supports energy efficiency (EE) or renewable energy (RE) resources.
Number of Projects Completed	The number of projects completed using program funds since the program's inception.
Description	A brief description of the program's purpose.
Website	A website providing more information about the program.
Representative Project	Where available, details on a representative project supported by the program.
Additional information	Any additional information (including contacts) considered useful.

[97] Owners must not reside on the property in order to qualify. In personal correspondence to Cadmus, PG&E program staff estimates the OBF program provided two loans to PG&E multifamily customers in the first half of 2013 for common area improvements.

Additional Resources

Bell, Catherine J., S. Nadel and S. Hayes. On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices. Report Number E118. American Council for an Energy-Efficient Economy. December 2011.

Energy Efficiency Financing in California – Needs and Gaps. Harcourt, Brown and Carey. July 2011.

Improving California's Multifamily Buildings: Opportunities and Recommendations for Green Retrofit & Rehab Programs (DRAFT). California Home Energy Retrofit Coordinating Committee. October 2010. Available at http://www.builditgreen.org/_files/Admin/HERCC/MF_HERCC_report_10152010.pdf

McKibbin, Anne, A. Evens, S. Nadel, and Eric Mackres. Engaging as Partners in Energy Efficiency: Multifamily Housing and Utilities. CNT Energy and American Council for an Energy-Efficient Economy. January 2012. Available at http://www.cntenergy.org/media/Engaging-as-Partners-in-Energy-Efficiency-MF-Housing-and-Utilities-Final-012512.pdf

Partnering for Success: An Action Guide for Advancing Utility Energy Efficiency Funding for Multifamily Rental Housing. National Housing Trust. March 2013. Available at http://www.cleanenergyfinancecenter.org/wp-content/uploads/partnering-for-success-action-guide.pdf

Recognizing the Benefits of Energy Efficiency in Multi-Family Underwriting. Steven Winter Associates. January 2012. Available at http://www.cleanenergyfinancecenter.org/wp-content/uploads/DBLC_Recognizing_the_Benefits_of_Energy_Efficiency_01_12.pdf

Section 8. Conclusions and Recommendations

The ESA Program is designed to provide subsidized energy-efficiency services to low-income households that cannot otherwise afford energy-efficiency upgrades. The scope of this study was limited to research relevant to eligible ESA participants (income-qualified households—the tenants) living in multifamily buildings. The purpose of the study was to obtain information regarding the ESA Program's long-term vision of providing cost-effective energy-efficiency services to 100% of eligible and willing customers by 2020. Additionally, the Cadmus team was directed to "develop alternative program design, delivery strategies, and measure offerings for consideration by the study team[98]" that are consistent with the Commission's direction that the program will be "directed, administered, and delivered in a manner so as to yield significant energy savings.[99]"

To achieve optimal energy savings, the Commission also requires that the ESA Program must be "administered cost-effectively to yield maximum energy savings at *reasonable costs*.[100]" Decision 12-08-044 directs the IOU's to develop strategies that (1) address the full range of opportunities in participating buildings, (2) streamline program processes and program delivery, and (3) target outreach to most effectively reach multifamily buildings.

This section offers recommendations for program design and delivery strategies aimed at helping the California IOUs develop and advance long-term plans.

The section is organized under these topic areas:

- ***Methodology*** for development of strategy recommendations.
- ***Key Considerations*** regarding the ESA Program objectives and future direction that provide context for the Cadmus team's analysis.
- ***Findings and Conclusions*** drawn from the Cadmus team's research with consideration for likely trade-offs and potential impacts on costs associated with implementing recommendations.
- ***Recommendations*** for addressing identified program barriers and enhancing the existing program design and delivery strategy. These recommendations presented are aligned with the two specified objectives.

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98 ESA Multifamily Segment Study Research Plan, Prepared for the Study Team. February 25, 2013.

99 California Public Utilities Commission Decision 12-08-044. August 23, 2012, p. 3.

100 Ibid.

Methodology

To draw conclusions and develop recommendations, we consolidated key findings from the Cadmus team's research associated with various research questions and documented emerging themes. The research was guided by the ESA program and these objectives:

- To support the ESA Program's long-term vision of providing cost effective energy efficiency services to 100% of eligible and willing customers by 2020, and
- To yield maximum cost-effective energy savings in the low-income multifamily sector at reasonable costs.

In addition, three researchable questions identified in the Commission Decision 12-08-044, provided underlying context for our research and conclusions:

- How can the current multifamily program offering, in particular the multifamily component of the ESA program, be modified to better meet the needs of low-income multifamily residents?
- How can integrated outreach, education, and marketing be most effective in reaching low-income multifamily housing owners/operators?
- How can the current service delivery approach be modified to address multifamily, energy-efficiency programming concerns?

To draw conclusions and develop recommendations, the Cadmus team documented significant findings and emerging themes from market characterization research, reviews of comparison programs, assessment of the existing program landscape in California, and surveys with owners and operators of multifamily buildings with low-income tenants. Recommendations were also informed by interviews with IOU program managers and the Study Team, program staff involved with five comparative multifamily programs in other states, and representatives from low-income advocacy groups or stakeholders who work with market rate and affordable (rent-assisted) multifamily buildings. From the research, we categorized findings reflecting participation barriers, drivers, and potentially replicable models according to functional areas, such as eligibility rules, participant intake and enrollment, technical and administrative support, marketing and outreach, and delivery and implementation.

Our task was to draw upon this research to identify opportunities to reach deeper into the low-income multifamily market, addressing the needs of as many low-income households as possible while maximizing cost-effective energy savings in this sector. It is important, however, to note the following:

- Some research findings are drawn from secondary sources and input provided by interested stakeholders who may have specific positions on the existing programmatic context or larger programmatic objectives.
- The study's scope, budget, and schedule as well as constraints associated with accessing data for discrete sub-segments of the multifamily housing market limited our ability to fully represent the opinions or objectives of building owners of all property sizes, nor robustly represent subsidized, affordable housing and market-rate housing.

- While the study gathered survey data from property owners and operators in multifamily buildings with low-income tenants, it did not include direct outreach to low-income tenants nor visits to multifamily properties, so findings may not necessarily reflect the specific needs or opinions of the full breadth of potential participants in the ESA Program's multifamily component.
- Some findings and recommendations included in this section represent a deviation from the existing rules and program guidelines under which the California energy efficiency programs currently operate; and implementation of some recommendations would require a change in program rules at a legislative or Commission level.

Key Considerations

In combination, the program objectives under which the Cadmus team conducted its research presented a challenge for the study. In an implementation context, the ESA Program's current delivery strategy is designed around its mission to deliver program services that benefit individual households and as such is well suited to achieving the objective of maximizing the number of low-income multifamily customers benefitting from the program. However, this will become increasingly difficult as the program matures. Additionally, , achieving the second objective (maximizing cost-effective energy savings) and complying with some of the strategies recommended in Decision 12-08-044,[101] implies a preference for program services that appeal to and engage building owners as a way to reach the individual tenants in each unit and capture opportunities for more extensive building upgrades.

Put more simply, the ESA Program's goal to provide cost-effective services to as many low-income households as possible, and the Commission's objective to maximize energy savings implies different programmatic strategies and are in some ways contradictory. In an implementation context, the first requires that the program's eligibility rules, program delivery strategy, eligible measures, incentive structure, and marketing tactics be centered on benefiting individual low-income customers living in multifamily dwellings while the second is more consistent with a program designed to target building owners and managers and provide a broader and more complex set of services that reduce lost opportunities and maximize energy savings.

With potentially competing objectives as a backdrop, the following sections present research findings, conclusions and recommendations under two objective scenarios: (1) reaching more income-eligible people and (2) increasing or maximizing energy savings while administering the ESA Program cost-effectively to achieve both objectives at reasonable costs.

The development of program design and delivery strategies going forward will require the IOUs and Commission to carefully consider these recommendations and the potential costs and benefits inherent in efforts to achieve each objective.

[101] Specifically strategies 3, 4, and 5 recommend greater marketing, coordination, and delivery consistent with a building, rather than tenant, approach. See Section 6, under Decision-12-08-044.

Findings and Conclusions

The findings and conclusions are presented in two sections: reaching more income qualified households, toward providing services to 100% of eligible and willing income-qualified customers living in multifamily buildings by 2020, and, maximizing cost effective energy savings by providing services to the low-income multifamily segment.

Reaching More Income-Qualified Households

1. ***While the ESA Program has addressed a portion of the low-income multifamily households statewide, as the program matures it may become more difficult to reach less accessible populations.***

As described in Section 3 of this report, the Cadmus team used data from the 2011 American Community Survey and GIS analyses to estimate the number of low-income multifamily households in California and apportioned those households by IOU service territory, by county, and by census tract. A second data source, the 2011 American Housing Survey, provided a profile of the low-income multifamily segment on additional metrics such as building vintage, equipment, and amount of rent paid. Through this analysis, we found that low-income multifamily households in buildings with five or more units represent approximately 9% of total residential households in California, 32% of low-income households, and 42% of multifamily households, for a total of 1.175 million households.[102]

ESA Program data available to the Cadmus team suggest that that between 25% and 48% of eligible and willing multifamily households participated in the IOU's programs between 2007 and 2012. Our research suggests that participation is highest where there are known concentrations of qualifying multifamily households. Over the six-year period from 2007 to 2012, we estimate that as many as 75% of qualifying multifamily households have participated in some areas. In other areas, however, one percent or fewer qualifying multifamily households have participated.

In some instances, this disproportionate participation may be because there are few qualifying multifamily households to begin with; but this apparent regional difference in penetration points to the fact that not all households will be equally accessible. In particular, our modelling of ESA Program participation by census tract suggests that low-income multifamily households living within relatively affluent areas are less likely to receive program treatment. Additionally, because mobility among low-income households appears to be high, it can be difficult to locate 100% of eligible households. Finally, there will always be buildings with owners or managers who are uninterested in investing in their buildings (or unwilling for other reasons).[103] Our research and the difficulty encountered surveying and interviewing market rate building owners indicates that some buildings may fall into this category of the harder-to-reach and motivate-to-take-action. The implications are that, over time, the program will

[102] Section 3, Table 16 includes some double counting of households, because some households are served by two of the utilities.

[103] In testimony the IOUs provided to the Commission

need to dedicate increasing resources to reach all households, with very likely diminishing returns for equal levels of effort as the percentage of households yet to treat decreases. We do not see evidence of an allowance for this tendency in the current rate of program participation, nor evidence in planning for future years.

2. The list of measures offered by the existing ESA Program is comprehensive but does not result in large energy cost savings, on average.

The ESA Program relies on a list of approved measures that apply across all ESA participant types (single- and multifamily); it does not offer any measures exclusively for multifamily buildings, nor does it explicitly exclude any measures from multifamily buildings. However, fewer ESA Program measures are typically feasible to install in multifamily units than in single family buildings. For example, with fewer exterior walls, multifamily units present less opportunity (and a lower need) for air sealing, and multifamily units may not have access to an attic that could be insulated. [104] Furthermore, under existing ESA Program rules, a tenant unit must offer opportunities to install at least three different measures (i.e., lighting alone is not sufficient) to qualify for program services. Tenant units that do not meet this criteria cannot be treated.

Among PG&E customers the average participating multifamily household in 2012 is estimated by the program to save 217 kWh per year, equivalent to about $3.08 per month at retail energy costs of $0.17 per kWh.[105] Among SCE customers the average annual electric savings is estimated by the program to be 362 kWh, worth about $5.17 in monthly savings. Cadmus' research found no evidence that the tenant units treated by the ESA Program require more or different measures than those currently available in the list of program-approved measures. Differences between utilities generally conform to different fuels they offer and to the different climate zones prevalent in their territories. Therefore, it appears that increasing energy savings will likely require addressing shell and building system (e.g., HVAC and DHW) upgrades.

3. Specific market data can help the IOUs develop customized delivery strategies targeting specific climate zones, building vintages, and equipment.

Statewide, the population of low-income multifamily households is characterized by considerable variability in the social circumstances of the households and, more germane to the current research, in the physical structures and the energy-consuming equipment with which they live. While Cadmus' research points toward various elements that may suggest energy efficiency opportunities and/or new pilot approaches, compiling these diverse elements into multi-dimensional territory profiles that account for climate and market variability would require a complicated analysis reliant on multiple assumptions. Nevertheless, characteristics identified through our research can help inform the IOU's

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[104] Utility estimates of annual savings for CFLs are 15 kWh per year per measure, for envelope and air sealing 45 kWh and 0.37 therms per household, and for DHW measures 0.88 therms per household.

[105] Retail cost is for the state of California from EIA, November 2013, "Electric Power Monthly with Data for September 2013." U.S. Department of Energy.

measure delivery approach and support targeted marketing and outreach strategies to help capture new tenant participants to the ESA program.

The following findings highlight potential opportunities.

- **Target buildings by vintage.** 68% of low-income multifamily households live in units built before 1980, representing approximately 766,000 households. This is the segment most likely to benefit from shell improvements, though buildings of later vintage may also benefit and some of these pre-1980 units may have already received shell upgrades. Older buildings are also indicative of older equipment, which could be due for an upgrade or replacement.
- **Increase shell improvements in specific climate zones.** The California IOUs have approximately 160,000 low-income multifamily households in California climate zones 11 through 16, all of which have relatively large heating and especially cooling needs. We estimate about 79,200 low-income multifamily households living within buildings in high-need climate zones 11 through 16 are likely in need of shell improvements. Based on utility measure costs of between $104 and $202 per unit for envelope and air sealing measures, it would cost about $12.1 million to serve the number of households that are likely in need of shell improvements.
- **Develop a strategy for identifying and upgrading equipment at the end of its useful life.**
    - About 347,000 households (24%) among the IOU's low-income multifamily housing units have heating equipment that is 20 years old or older. It is difficult to accurately assess the number of systems represented among households with forced air because these furnaces can serve numerous households; however, data suggests that about 21,000 buildings (serving an estimated 216,000 households) have furnace equipment at the end of its effective useful life. Assuming incentive levels were set to cover 100% of the estimated incremental cost of $1,735 per building, this implies a program cost of $36.5 million to replace the forced-air units that are past the end of their effective useful lives.
    - An estimated 36% of low-income multifamily households have central air conditioning, and 28% of these households have central AC equipment that is 20 years old or older. Our estimates yield 39,500 central AC systems that are 20 years old or older. Further, surveys revealed that the need to replace original AC equipment is closely related to building vintage, with 47% of respondents managing buildings built in 2000 or later saying central AC equipment is original and only 8% of respondents managing buildings built before 1980 saying the AC equipment is original. We estimate the full equipment incremental cost of replacement on failure (per unit) to be approximately $714 (Table 69). Thus the program's estimated cost of replacing all central AC systems at the end of their useful lives, assuming incentive levels are set to cover the full incremental cost of equipment replacement, are approximately $28.2 million.
    - In regions where energy savings are greatest from AC upgrades, approximately 25,200 buildings in climate zones 11, 12, and 13 are cooled by central AC equipment that is 20 years old or older. In climate zones 14 and 15, there are 5,800 multifamily households

that are cooled by central AC equipment that is 20 years old or older. Again using incremental cost of equipment replacement as an estimate of program spending, targeting only AC systems at the end of their useful lives in these climate zones would equate to approximately $1.4 million.

- **Don't abandon the refrigerator replacement effort.** Roughly 94,000 low-income multifamily households have refrigerators 15 years old or older. In PY 2012, the IOUs began replacing refrigerators built before 1999. PG&E replaced 2,046 refrigerators in multifamily households through the ESA Program; SCE replaced 1,889 and SDG&E replaced 340. Based on ESA Program measure costs for PY 2012, and using the average price of $717, it would cost $67 million to replace all refrigerators that are 15 years old or older.
- **Screen all buildings for common area lighting opportunities.** Multifamily building owner and operator surveys revealed that, while larger buildings (250+ units) are more likely to have a common area, they are also much more likely than smaller buildings to have replaced common area lighting (79%). Opportunities remain for common area lighting upgrades in smaller buildings and complexes. Fifty-eight percent of property owners managing buildings with 25 or fewer units indicated their properties had common areas and about half (49%) noted they had not replaced common area lighting equipment. We estimate this equates to approximately 36,000 buildings with five to 25 units where common area lighting opportunities may exist. At an average cost of $160 per building for common area upgrades, the estimated cost of implementing this upgrade is approximately $5.8 million.

To support the IOUs' evaluation of these opportunities and those discussed in the next conclusion, we provide estimated costs in Table 69. These estimations are based on data from the existing California programs serving multifamily buildings, and the incentive values serve as a proxy for related ESA Program costs for incentivizing similar measures.

Table 69. Estimated Incentive Cost of Common Area/Central System Upgrades[106]

Service/Measure	Specification	Estimated Full Cost per Building	Estimated Incremental Cost
Whole building assessment[1]	5-20 units	Varies	$5,000
	21 -100 units	Varies	$10,000
Common Area Lighting[2]	Linear fluorescent lighting and CFL fixtures and lamps	$160	NA
Central Cooling[3]	Central AC unit	$4,000	$714
Central Heating[4]	Central heating system	$7,828	$1,735

1. In EUC MF, a $5,000 incentive is offered for building assessments in properties with 5-20 units (SoCal REN) or 5-30 units (PG&E); and a $10,000 incentive for assessments in properties with 21-50 units (SoCal REN) or 31-100

[106] Estimates in this table come from data derived from existing California programs (ESA/MFEER/EUC MF) that address multifamily housing using a range of different approaches; however actual costs may range considerably based on building size, construction and equipment characteristics and project scope.

units (PG&E). See Table 59.
2. MFEER Program average cost data. Common area lighting upgrades are typically cost-effective; MFEER covers the full replacement cost.
3. Full cost: SCE's ESA program estimate representing average cost for central cooling replacements plus duct testing and sealing conducted by SCE in 2013 through August. Incremental cost: DEER 2008 Cost Data.
4. DEER 2005 Residential Prototype Characterization Study and DEER 2008 Cost Data (weighted by household type and climate zone) and DEER 2008 Cost Data (weighted by household type and climate zone).

4. *Heating and cooling system upgrades offer a potential untapped savings opportunity for the ESA Program's target population.*

Cadmus' research revealed that a majority of low-income multifamily buildings, which together include nearly 800,000 tenant units, were constructed before 1980 and therefore may offer energy savings opportunities associated with the building envelope. Data on equipment vintages further suggest that opportunity remains for implementing heating and cooling system upgrades in low-income multifamily properties. Forty-nine percent of low-income multifamily households with gas heat have equipment that is 20 years old or older, while 32% of low-income multifamily households with electric heat have equipment as old as 20 years or more.

On the cooling side, low-income multifamily households tend to have a higher saturation of room AC and less central AC systems than do adequate-income households[107]. Among low-income multifamily households with room AC, only 25% of the equipment in use is ENERGY STAR qualified.

The ESA Program does not typically include provisions for replacing central system upgrades in master-metered buildings as the benefits of these upgrades are more difficult to justify when energy costs are paid by the building owner or landlord. However, in buildings that are not master-metered and where tenants pay their own utility costs, the energy savings available through central heating and cooling system upgrades accrue to the individual low-income households. Based on findings from building owner and operator surveys, 94% of the low-income multifamily buildings in California are individually metered for utilities; only 28% of respondents indicated electricity is included in rent and 26% indicated that gas is included in rent. In buildings that are centrally heated and/or cooled, and where tenants pay their utility bills or gas and electricity are included in the rent, there is an opportunity to capture energy savings through central-system upgrades that are consistent with the ESA Program's mission.

As noted in Section 3, Figure 31, about 68% of market rate buildings are aging and 39% of rent-assisted are aging buildings. This is important to note because different types of interventions may be needed for the different market sectors. We lack specific information about how to engage the market rate property owners, the larger segment with aging buildings. Additional research may be needed. However, survey findings indicate that a significant portion of multifamily building owners (both rent-assisted and market rate) replace equipment only when required to do so due to equipment failure.

[107] See Section 3, under Equipment in Existing Units.

When making purchasing decisions, many building owners and operators select equipment based on initial cost rather than efficiency and their decisions may further be influenced by a lack of available capital. These factors may point to an opportunity for the ESA Program to influence building owners' purchasing decisions toward more energy efficient options at the time these decisions are made, by offering a financial incentive designed to cover only the incremental cost of higher-efficiency equipment over standard efficiency models. Data from the existing California programs indicate that an incentive designed to cover incremental cost equates to approximately $1,736 for heating system upgrades and $714 for cooling system upgrades (see Table 69). As described above, based on Cadmus' estimates of heating and cooling systems at or near the end of their useful lives, the total cost to the program of offering central system upgrades would be approximately $65.7 million (i.e., $36.5 million to replace all potentially eligible heating systems and $28.2 million to replace all potentially eligible cooling systems).

5. Obtaining Property Owner Waiver Forms is a participation barrier.

For the low-income tenant in a multifamily building, participation is a partnership between the tenant and building owner. To provide services to multifamily renters, the ESA Program requires building owners to sign a Property Owner Waiver form, authorizing efficiency improvements in the units to be treated[108]. This can be a barrier to the tenant's participation since some landlords are difficult to reach or unresponsive to the program's efforts. The building owner can be difficult to engage, but, once engaged communications with the owner presents an opportunity to work with them to access other incentives and upgrade other systems.

6. The existing ESA Program policies associated with addressing an entire building may be missing opportunities to treat more tenant units and increase energy savings within a given building.

When 80% or more of the individual dwelling units in contact with the envelope in a given building or complex can be independently income-qualified, the ESA Program is able to treat the building shell. And, if 80% of units in contact with the ceiling are income qualified, the ESA Program can add ceiling insulation. Achieving the 80% threshold also enables the program to treat any unoccupied units in a given building; however the current policy disallows treating units within the remaining 20% that are occupied but not income-qualified[109]. Any occupied units for which the tenant is unable or unwilling to participate in the income verification process cannot be treated. If a sufficient number of tenants can be qualified to reach the threshold, the policy of not treating occupied units may be missing savings opportunities that, due to tenant mobility are likely to benefit a low-income household within three years of being treated.

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[108] IOUs allow property owners to sign a single Property Owner Waiver that is applicable to multiple units in a complex to be treated.

[109] As described in the ESA Program Policies and Procedures Manual, "To qualify an entire multifamily building for other measures offered by the program (defined as 80-20 measures), at least 80% of all (occupied and unoccupied) dwelling units must be occupied by income-qualified households."

7. Housing unit mobility among low-income multifamily households will make it difficult to locate and treat 100% of eligible households.

The goal of offering the ESA Program to all (willing and eligible) households by 2020 must reflect the fact that the low-income multifamily sector is quite literally a moving target. The ESA Program treats *housing units* in order to provide benefits to *households*; but households are highly mobile, whereas the treatments remain behind. By 2020, based on AHS data for the California low-income multifamily sector, we would expect 82% of low-income multifamily households to have moved to a different housing unit at least one time. There are several implications associated with this mobility:

- Some qualifying households will benefit without ever participating in the program, by moving into a unit that has been treated and vacated.
- Some *unqualified* households will benefit from the program by moving into a unit that has been treated and vacated.
- Treating vacant units can provide benefits if there is a high probability that a qualified household will move in during the lifetime of the measures installed.
- Treating units where unqualified households live can provide benefits to qualified households if there is a high probability that a qualified household will move in during the lifetime of the measures installed.

In cases where a building qualifies for building-wide treatment (80% of occupied units have been verified as eligible), but some units have not been verified, it is very likely that within the lifetime of installed efficient equipment a low-income tenant will move into that unit. Treating every unit in a building that is largely low-income increases the probability that eligible households will eventually be reached and benefit from the upgrades installed by the program. The average cost to treat an apartment unit is relatively low: IOU ESA Program measure cost data to treat multifamily unit ranges from $200 to $500 per unit.

Maximizing Cost-Effective Energy Savings

Guidance provided by the Commission and Decision 12-08-044 as well as information gathered from varied stakeholders points to a desire for the ESA Program to increase its focus on maximizing cost effective energy savings. Adopting a goal to maximize energy savings while administering the ESA Program cost-effectively, either as an alternative or an accompaniment to the goal of reaching as many income qualified households as possible, suggests that the ESA Program may need to shift how it approaches building owners.

There is currently no provision in the ESA program for subsidizing upgrades to central systems or common areas—these are expected to be addressed through other multifamily energy efficiency programs. Because the ESA Program interacts with building owners directly each time a rental unit is treated, there may be opportunities for the ESA Program to further leverage this contact by explicitly encouraging whole building audits and upgrades to aging central systems. If this were coupled with a strategy of treating all units in qualified buildings, lost opportunities could be minimized.

Important aspects of this strategy include: (1) conducting a thorough energy assessment to analyze the potential costs and benefits of central system upgrades and identify and mitigate health and safety issues and (2) obtaining the owner or landlord's commitment that tenants benefit from the reduction in energy costs associated with central systems in their buildings. Benefits accrue to the tenants through increasing the safety and comfort of their buildings, and helping to maintain affordable rental rates by mitigating operational cost increases (e.g., not passing energy cost increases on to tenants through rent).

Because the financial benefits of central system upgrades are often assumed to benefit the building owner or property manager, it will be important for policy makers to carefully consider the requirements that might be needed to ensure that tenants benefit. While this approach merits consideration, over-emphasis on common area and building-level measures could redirect program funds from other efforts that may be better aligned with the ESA Program's vision.

8. The ESA Program may be able to increase energy savings results and likely serve more low-income households by relaxing the eligibility requirements to address low-income multifamily buildings as a whole.

The ESA Program requires that 80% of tenants be income qualified before the program can move to simpler self-certification for the remaining units and install building shell upgrades. The CSD program, which relies on Federal LIHEAP funds and DOE eligibility rules, uses the federal building approval guideline of 66% income-qualified residents[110]. Further, as shown in Chapter 5 (under "Eligibility Requirements"), none of the comparison programs researched require this level of income verification to either address all tenant units or to install whole building solutions. While the comparison programs are all focused on providing services at the multifamily building level rather than at the tenant level, all of these programs have limited budgets and all have adopted a mission of supporting low-income households.

The IOUs have taken some steps to simplify building verification for the ESA Program by adopting categorical eligibility policies for individual tenants who qualify for other assistance programs, and by identifying areas where census data suggest there is a high concentration of low-income households and allowing households to self-certify their income rather than providing documentation in these areas.[111]

All of the comparison programs the Cadmus team reviewed allow building owners to provide income qualification documentation for their buildings. While this primarily applies to owners of subsidized properties who maintain tenant income records as a condition of the subsidies they receive, NYSERDA

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[110] See Chapter 6, under "Income Eligibility."

[111] Categorical eligibility means that a tenant can participate in the ESA Program if they provide documentation to prove they are participating in another income-qualified program with equally stringent standards. Self-certification means the tenant can participate in the ESA Program if they sign a form stating that they are income qualified, but the tenant does not have to provide income documentation.

uses rent as a proxy for income through its "rent roll" certification, allowing market rate buildings to qualify without going door-to-door to verify tenant income. Through this method, owners calculate tenants' annual household income based on rent and occupancy, assuming housing costs consumes 30% of household incomes. The Cadmus team's research found that NYSERDA's estimate that rent makes up 30% of income is far lower than the actual proportion of income spent on rent for most of the low-income multifamily population (making 30% a conservative estimate). Similarly, many of CNT Energy's participants come to the program as referrals from Chicago's Community Investment Corporation, which primarily works with buildings serving low-income populations. Thus, these programs eliminate the cost of individual income verification by allowing alternative income indicators to serve as eligibility verification.

9. Neither the current ESA Program nor the other multifamily sector programs currently offered are designed specifically to maximize energy savings in low-income multifamily buildings.

As described in Section 6 of this report[112] the energy-efficiency services and incentives available to multifamily customers in California are divided between programs that deliver benefits to the tenant as the customer and programs that deliver benefits to the building owner as the customer. Each of these existing programs is designed to achieve its own set of goals and objectives and operates under its own delivery and administrative rules. Each has its own customer targets (i.e., market-rate tenants, low-income tenants or building owners and operators), eligibility rules, available measures, incentive structures, and installation approaches (e.g., unit-level, common areas, or whole building).

Because the ESA Program's focus is on assisting low-income tenants with their utility bills and improving their quality of life, it covers only in-unit measures that directly affect a resident's energy costs[113] (and, as noted previously, building envelope measures can be installed when 80% of residents whose units touch the building's shell are income-qualified). Common area measures such as hallway lighting, that may or may not directly affect tenants' energy costs or produce individual household benefits, do not qualify for ESA Program funds. The MFEER and EUC MF Programs offer services focused on common areas and whole-building upgrades, but, while EUC MF does integrate with the ESA program on tenant qualified units and low-income qualified buildings may participate in whole building upgrades, neither program provides services or offers enhanced incentive levels specifically designed to overcome the capital constraints in low-income properties.

Put another way, the current multifamily program landscape in California has several programs that treat multifamily buildings (i.e., ESA, MFEER, EUC MF, and MIDI) but none that primarily or exclusively serve low-income residents. While property owners of low-income multifamily buildings can take

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[112] See Section 2, under question 5 and Section 6: The current California Landscape for Low-Income Multifamily Programs.

[113] Participants may also qualify for improvements that address health and safety, which contribute to their quality of life.

advantage of the program, the current programs do not provide incentives for common area and central system upgrades that are specifically set at levels to address financial barriers common to the low-income sector. Early results from the EUC MF program's first year of implementation indicate that there is interest among low-income multifamily building owners and operators in installing more comprehensive building upgrades.

The ESA Program's approach contrasts with that of the comparison low-income multifamily programs in other parts of the country that the research team examined. Like the ESA Program, these programs ultimately seek to benefit low-income households; however, they primarily target the owner of a multifamily building with low-income tenants, assuming they will benefit all residents of a building that is audited and upgraded. The comparison programs' focus on multifamily building owners is consistent with these programs' more comprehensive focus: in addition to measures in tenant units, they install upgrades in common areas and central systems. Some programs include a formal requirement to ensure benefits are passed along to income-qualified building residents of master-metered buildings. These programs require building owner participants to agree not to raise rents for a defined period following the retrofit and the program in Colorado further requires building owners to specify how they plan to use the cost savings from their efficiency improvements to benefit tenants; however there is no formal process in place to verify compliance or enforce the building owner's commitment.

The California Long-Term Energy Efficiency Strategic Plan and Decision 08-11-031 provide unequivocal direction to the California IOU's that the ESA program must evolve into a resource program that garners "significant energy savings" while providing an improved quality of life for California's low-income population. Decision 12-08-044 specifically recommends the IOUs implement eight strategies to help overcome ESA program barriers, including several that signal a desire for the ESA Program to work more directly with multifamily building owners and managers and provide a more comprehensive whole-building energy assessment by better leveraging other existing multifamily programs, including[114]: Strategy 3: update marketing approach to multifamily homes (building owners); Strategy 4: improve EUC/MIDI/MFEER coordination, and Strategy 5: establish a single point of contact (to coordinate the varying IOU programs for the multifamily segment).

10. Multifamily buildings undergoing significant upgrades offer opportunities for targeted, proactive ESA Program outreach.

In interviews with low-income housing stakeholders and advocacy groups, respondents expressed the importance of integrating ESA Program recruitment with building recapitalization events (Section 4). Respondents suggested that better collaboration with utilities to synchronize property recapitalization and asset management events with utility energy-efficiency programs could lead to a more cost-effective distribution of program benefits to both building owners and tenants.

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[114] California Public Utilities Commission Decision 12-08-044. August 23, 2012. Section 3.10.6.3. Also listed in Appendix A. Note that examination of these eight strategies or determining whether the steps were successful in reaching the multifamily segment were outside the scope of the Multifamily Segment Study.

Respondents indicated that many large and subsidized multifamily properties typically undergo major building upgrades every 15 to 20 years and that housing certified under the HUD program typically provide a 5-year investment strategy. These building renovations are thought to be the best time for property owners and managers to install energy efficiency upgrades as part of an overall building rehabilitation project. While this particular cycle may be specific to subsidized properties, market rate properties may or may not have comparable investment cycles presenting opportunities for energy efficiency upgrades.

All interview respondents (representing both market rate and rent-assisted housing) reported that multifamily property owners and managers use a layered approach to finance large retrofits and energy-efficiency improvements. Respondents representing affordable housing mentioned the importance of long-term planning for financing building upgrades due to the complicated financing arrangements that are frequently required. Some properties have multiple investors, each requiring a separate approval process before making upgrades that will increase debt to the property. Also, the investor approval process tends to be affected by the type of improvement under consideration. This suggests a potentially complex and long lead time for the investment decision making and approval process(we are not suggesting that they need higher levels of subsidies).

Note that these findings may be applicable to a relatively small population of large multifamily complexes and rent-assisted housing. Smaller and privately held properties might not undergo large-scale rehabilitation events, instead making equipment upgrade decisions as needed to address equipment failure or other small-scale improvements.

For those properties that engage in large scale rehabilitation projects, these significant upgrade events present the most advantageous opportunity for ESA to overcome barriers associated with attracting building owners' and decision makers to the program, encouraging investment in upgrades, and limiting inconvenience. The complicated financing process inherent in recapitalization highlights the need for property owners to coordinate with utility programs to scale the timing of major multifamily building upgrades with the ESA Program or another IOU-sponsored program in order to integrate efficiency improvements as part of the overall building rehabilitation project.

In a different set of surveys with multifamily building owners and operators, nearly half of rent-assisted housing operators indicated they plan for equipment purchases one to two years in advance with just one-quarter indicating they planned equipment upgrades less than one year in advance. In market rate housing, respondents reported nearly the inverse with one-quarter planning for equipment purchases one to two years in advance and almost half planning less than one year in advance. Both sectors reported they were most likely to upgrade or replace equipment when it breaks, which explains the relatively short planning horizon to replace equipment.

For subsidized multifamily housing, the building owners and managers tend to use HUD funds, grants, rebates, tax credits (for new buildings or solar upgrades), and cash reserve accounts. For market rate housing on the other hand, the building owners and managers depend primarily on cash accounts and

use a combination of bank loans, real estate investment trusts, and joint-venture partnerships to pay for building upgrades. The primary factor influencing decisions to make equipment upgrades or repairs is cost (which can hinder energy efficiency upgrades) (76%), with energy efficiency lagging, but ranking second (32%). Respondents identified a lack of access to capital as the primary factors that made it difficult to make energy efficiency upgrades. The majority, 65%, said they were not aware of any financing options that may assist with the expenses to upgrade or replace equipment.

11. ***Better coordination and technical support is needed for multifamily building owners and tenants who are eligible for multiple programs to ensure their participation derives maximum energy savings and other benefits.***

Cadmus' research found two key areas where offering technical and administrative support could improve both building operators and the tenants' experience with the program and help overcome barriers associated with navigating complex enrollment and implementation processes, particularly where multiple programs are involved and with complicated financing options.

Enrollment and Implementation

Among the strategies identified in Decision 12-08-044, several point to the need to streamline program delivery and in particular highlight an emphasis on a single point of contact. This need was echoed by low-income stakeholders and advocacy organizations Cadmus interviewed, who indicated there was a lack of contact people to help building owners and managers navigate participation. We note that while some efforts are underway to designate a single point of contact through the pilot EUC MF program, that role is limited to supporting building owner-participants in that program. Under the current ESA Program design, a single point of contact may not be appropriate, particularly in delivery efforts focused on a single tenant unit. However, efforts to broaden program services – either through the existing ESA Program or by bridging ESA to other programs – may create a greater need for a single point of contact to help coordinate program enrollment and implementation support for building owners and operators.

All of the in-depth comparison programs Cadmus reviewed use established systems to help building owners identify retrofits and guide them through the retrofit process, including providing some analysis of the building's energy use, conducting assessments to identify energy-saving opportunities, identifying the range of incentive and financing options building-owners can use to fund their retrofits, assisting these owner-participants in selecting installation contractors, and verifying the quality of installed measures. In most cases, providing this level of support involves designating an individual – either an external consulting engineer or internal program staff – to work with participating building owners and managers. While the comparison programs are not directly applicable to the ESA Program because they all address efficiency at a building level rather than at an individual tenant household level, the provision of technical support is cited as a key factor in the programs' success.

The comparison programs were notable for the presence and role of nonprofit and public benefit organizations in both administering and delivering services to multifamily buildings. These organizations sought to identify buildings and work closely with owners to develop scopes of work that captured all

cost effective opportunities. Several were able to facilitate or offer financing opportunities that further encouraged building representatives to take action.

As a whole, the comparison programs prioritized a comprehensive treatment of the buildings they targeted, with some covering substantial (if not all) of the retrofit costs. The wide range of costs per unit treated and spending relative to the total number of units in the comparison programs' respective territories can be found in Section 6, and illustrates the range of cost tolerance associated with reaching this challenging population. (In Tables 52 and 53 we compare the costs of electric efficiency measures and gas efficiency measures *per unit treated* for all of the comparison programs. In Table 54, we compare the comparison programs' spending *per multifamily unit in their service territory*.)

Complex Financing Options

The Cadmus team found that numerous financing opportunities may be available to multifamily building owners to support more costly energy efficiency upgrades. While a number of options exist, these programs vary widely in terms of the support they offer and their eligibility requirements. Existing options are limited by different factors, such as geography, eligible measures, eligible applicants, and available funding. This can make it difficult for building owners unfamiliar with the various options to identify the programs for which they might qualify, and to navigate the application process. The multifamily funding landscape is constantly changing and new financing programs continue to emerge. (Section 7 reviews 16 separate financing or grant programs that are currently active and applicable to the state of California.)

In surveys with property owners and managers, more than half the respondents (65%) stated they were not aware of financing options to help them pay for energy efficiency upgrades. Market rate owners were less aware of options (68%) than rent-assisted (41%). Cost was the primary reason respondents said they did not replace equipment with energy efficient models (53% of market rate and 21% of rent-assisted buildings).

The most prevalent theme to emerge from interviews with building owners, managers, and other stakeholders[115] was that the complexity of the financing landscape calls for a need for IOUs to provide help in navigating the energy-efficiency programs, the offerings, the requirements, and funding sources. This includes providing technical expertise and administrative support.

Recommendations: Reaching More Income-Qualified Households

The California IOUs have contributed to helping low-income populations reduce their utility costs and improve the comfort and safety of their homes through the ESA Program. Each utility is committed to continuous improvement of the ESA Program: they are working to align the program with the Strategic Plan goals and making steady progress to streamline operations and improve outreach to target low-income multifamily tenant populations. The individual IOUs should continue these efforts. The research

[115] Stakeholders and advocacy groups interviewed are listed in Appendix G.

team recognizes that the IOUs operate in fidelity to an existing programmatic framework that entails rules, policies, and procedures set by the Commission that may limit their ability to implement significant program design adjustments.

However, the research team also recognizes the potential challenge that lies ahead for the utilities in achieving their long term objective of addressing 100% of eligible and willing income-qualified populations by 2020. As the program continues to mature, it will become more difficult – and more costly – to recruit and enroll income qualified multifamily tenant participants that are harder to reach due to geographic constraints, absentee or uninterested landlords and other constraints that characterize the "high-hanging fruit."

Thus, the following recommendations are geared toward doing more within the existing ESA Program framework to reach the increasingly hard-to-reach populations and attract more income qualified households to the program. In general, the research team believes implementing the recommendations in this section would be feasible under existing ESA Program rules and do not require significant regulatory involvement.

1. ***Consider adopting customized recruitment and delivery strategies (by IOU) to target identified opportunities based on climate zone, measure and buildings characteristics, and geographic areas.***

The California IOUs have historically focused ESA Program marketing and delivery in areas with larger numbers of low-income populations based on census tract data. While this strategy is sound and should be continued, our research found that there may be pockets of low-income housing located amid more affluent households with higher median income, and low-income tenants living in market rate housing that, in some cases are not being captured by the current program approach. Furthermore, our analysis, of building and equipment saturations and vintages indicates there are likely remaining opportunities for upgrades to various measures within the existing ESA Program framework. Specifically, our research indicated that the ESA Program may be able to capture significant energy savings by targeting the following:

- Low-income populations residing in market rate housing and in areas with lower density low-income populations
- Older building vintages, indicating potential for shell improvements
- Heating and cooling systems at or near the end of their useful lives
- Climate zones corresponding to the greatest needs for heating and cooling
- Common area lighting measures, which are typically cost effective

The Low-Income Needs Assessment[116] currently underway could shed light on additional measures that could be offered to individual low-income units as well as buildings.

As tenant participants become more difficult to reach, the IOUs will likely need to reallocate some marketing resources away from other approaches to conduct more specific research and targeted outreach and messaging to harder-to-reach income-qualified tenants. Although the costs to capture these hard-to-reach customers are likely to increase as the program matures, conducting research and directing outreach dollars strategically to capture potential tenant participants meeting the criteria above can be more efficient and effective than broad-based outreach and messaging campaigns. (Relevant conclusion statements are 1, 2, and 3.)

2. ***In buildings where 80% of the tenants are income-qualified, treat all units in the building whether they are vacant or occupied, as well as the building shell.***

Treating all units at one time should create cost savings for contractors since they do not need to go back to the building to treat single units and is likely to save administrative costs for the program. Due to the mobility of rental populations, treating all units in buildings that meet the 80% low-income threshold is likely to benefit a qualified low-income household at some time over the life of installed measures.

Under current program offerings, the IOUs may have data in their ESA Program databases to determine the number of units that could have been treated but were not, using the 80%-20% rule. To assess the costs and benefits of this recommendation, the IOUs should conduct further research to identify the portion of buildings their contractors have sought to qualify at the 80% threshold, but that failed to qualify because an insufficient number of residents were able or willing to provide the income documentation required for verification. Quantifying the savings that could have been achieved had the building gone forward with shell improvements and installed measures in every tenant unit could help the IOUs and Commission determine whether the cost to deliver these services would be outweighed by the cost savings associated with a more relaxed income verification threshold. (Relevant findings, including estimated costs to support this recommendation are provided under conclusion statements 6 and 7.)

3. ***Consider options for expanding current process exceptions to subsidized buildings.***

The ESA Program allows exceptions to its income verification procedures under two scenarios:

1. The Program allows individual tenants *categorical eligibility* when they qualify under a range of other specified assistance programs.
2. Under *targeted self-certification* protocols, the Program treats buildings in specific geographic areas where census or other demographic data suggests that 80% or more of the population

[116] Evergreen Economics. Needs Assessment for the Energy Savings Assistance and the California Alternate Rates for Energy Programs – Volume 1: Summary Report and Volume 2: Detailed Findings. November 25, 2013.

meets ESA's income eligibility criteria. This allowance enables tenants within the targeted building to self-certify their income eligibility to receive program services.

Recognizing that these exceptions to the existing income verification rules have already been adopted by the Program, the Cadmus team recommends the IOUs consider whether expanding the variances under which a ***building*** qualifies for relaxed income verification requirements would increase the number of tenants the program is able to identify and serve and offer other program benefits.

For example, this might include expanding the categorical eligibility concept to a building level by allowing documentation that certifies a building for any income-based subsidy program (e.g., Section 8, deed-restricted, HUD, TCAC, HCD or USDA) to serve as qualification to enroll tenants through a targeted self-certification process or to enroll the building based on assistance program documentation provided by the landlord or building owner and therefore bypassing individual tenant verification requirements. Buildings that meet this classification would be eligible for the same services provided by the current ESA Program under the 80%-20% rule (i.e., treating all eligible tenant units and installing building shell upgrades). It is important to note that the Commission is currently reviewing policies associated with categorical eligibility for individual households; therefore prudence dictates that decisions around expanding these rules be delayed until they can be informed by the results of this review process.

The evaluation of the ESA Program's categorical eligibility policies was limited to a review of whether the income qualification requirements for various programs were consistent with the ESA Program's requirements at the household level. The recommendation suggests that the IOUs and Commission expand on this to investigate the implications of applying categorical eligibility at the multifamily building level. This investigation would involve not only determining which buildings have income qualification requirements consistent with the ESA Program, but also the potential impact on the ESA Program of revising categorical eligibility policies in terms of the number of units likely to qualify under any new standard.

The potential benefits of expanding the rules that allow for relaxed income verification procedures at the building level include: administrative cost savings associated with a simpler verification process (building rather than tenant-based income verification); faster, less onerous process for program contractors, tenants and building owners (supporting the study research question "How can the current multifamily program offering, in particular the multifamily component of the ESA program, be modified to better meet the needs of low-income multifamily residents?"); and increased opportunity for the program to serve more income-qualified households. We note that this recommendation impacts a relatively small population of buildings, estimated at approximately 18,000 buildings or about 2% of the residential population or 6% of the low-income population, thus the potential benefits to the program overall are likely to be relatively small. Additionally, implementing the recommendation would increase program costs by enabling treatment of more tenant units, and potentially increasing the number of buildings to qualify for expanded measures under the 80-20 rule.

Under a less rigorous self-certification process, this recommendation may increase the potential risk of unqualified tenants receiving program services. However, the Cadmus team's research indicating that more than 90% of a building's units will be inhabited by low-income households during a three-year cycle, suggests that low-income households will eventually benefit from program efforts to treat all units in an otherwise income qualified building.

To determine the viability and potential costs and benefits of implementing this recommendation, the Cadmus team recommends additional research be undertaken first to determine whether potential building-level assistance programs' income eligibility requirements align with those of the ESA Program. Additional data and analysis are needed to accurately quantify the potential costs and savings associated with this recommendation, including:

- Calculate the average cost to income-verify a single unit.
- Quantify average energy efficiency savings available in a single unit.
- Determine the potential magnitude of buildings that qualify for housing assistance subsidies that have not already been addressed by the Program, and the number of untreated units within that population (taking care to accurately quantify the number of potentially qualifying units in buildings where individual units are treated but not the whole building).
- Calculate the total cost savings associated with not verifying income for every unit, individually, in the total population of potentially qualifying buildings.
- Calculate the cost of treating all untreated units in the population.
- Calculate the potential magnitude of energy savings that could be captured by treating additional units and buildings under the expanded rules.

(Relevant findings, including estimated costs to support this recommendation are provided under conclusion statements 6 and 7.)

Recommendations: Maximizing Cost-Effective Energy Savings

Guidance provided by the Commission and Decision 12-08-044 to strive for maximizing cost effective energy savings points toward a comprehensive approach to treating low-income multifamily buildings. This approach, in turn, requires that the ESA program treat building owners and managers as the customer and therefore requires an adjustment to the ESA Program's underlying marketing and delivery approach.

The research team recognizes that the IOUs have designed and implemented the ESA Program to comply with state level policies, rules and procedures and to achieve specific objectives associated with providing services to low-income populations (at the household level). The research team is not recommending that the ESA Program eliminate a tenant-based offering for multifamily residents of buildings whose owners are unwilling to pursue a whole-building approach, nor does it advocate that the ESA Program support upgrades that only benefit building owners. In implementing this report's recommendations, there are steps the IOUs can take to ensure that tenants benefit from larger upgrades that building owners undertake.

The recommendations offered below provide suggestions that entail more significant programmatic changes and potentially adjustments at a higher level than can be accomplished by the individual IOUs. They are, therefore, offered for consideration and further exploration with program sponsors and partners, stakeholders, and the Commission. In many cases, the research team does not have specific data to help inform the costs and potential benefits of implementing the recommendations; further research is recommended to determine the likely impacts of implementation.

1. ***Review the rationale behind the 80-20 threshold for treating all units and building shell to ensure it remains consistent with the current policy objectives.***

The Cadmus team understands that the rules requiring 80% of a building's tenants be income qualified to treat unoccupied units and the building shell were established with specific policy objectives in mind. However, adopting a lower threshold, such as, for example, the 66% threshold used by CSD, for qualifying unit upgrades building-wide could potentially produce benefits. Potential benefits could include reduced verification costs, and allowing the program to reach a greater number of low-income households and provide greater overall energy savings. Since low-income multifamily households are mobile and hard to reach, the advantage of income-qualifying a building at a lower threshold is that additional units can be treated, and over time, additional low-income multifamily households are likely to benefit. Aligning the building-level income qualification rules to be more consistent with the CSD program could also provide ancillary benefits such as reducing confusion, easing coordination between the two programs and contributing to the ESA Program's long term goal, but of course, lowering the threshold comes with additional cost.

Potentially negative consequences associated with this approach could include some risk associated with providing program services to non-income-eligible households, thereby straining program resources and/or diverting spending from other areas, e.g., the single family segment of the ESA Program, and inappropriately allocating ratepayer funds. Data were not available to determine the additional number of units and building shell upgrades that could potentially qualify if the rules for treating buildings were changed from 80% verification to 66% (or some other lower level of verification) and it is not known whether the administrative cost savings associated with a reduced verification burden would outweigh the additional resources required to address potentially non-eligible households. However, as we noted previously in this section, due to the level of mobility among renters in multifamily housing, and particularly in buildings where the majority of tenants qualify as low-income, it is likely that a qualified low-income tenant would benefit from installed upgrades at some point during the lifetime of installed equipment.

The Cadmus research team recognizes that income eligibility requirements around building upgrades are set by the Commission. It is important to note that the IOUs are implementing these programs with fidelity to current program rules. This recommendation considers an option that would involve rule changes. Therefore we recommend the Commission revisit the rationale behind setting the building level threshold at 80% within the context of current policy objectives and market characteristics.

Researching the impacts of lower eligibility criteria in other jurisdictions in greater detail can help inform this exercise.

If such a change is determined to be consistent with state and program objectives, the IOUs should work with the Commission to determine what would be involved in changing eligibility rules to be more consistent across programs. It is possible that with additional research, the Commission might decide that reaching every low-income single family household is more important, more feasible, and more cost-effective than reaching every low-income multifamily household. (Relevant findings to support this recommendation are provided under conclusion statements 8.)

2. Offer cost-effective common area measures and incentives that cover the incremental cost of central heating and cooling system replacements.

Cadmus' research found that a majority of building owners and operators of both low-income and market rate buildings make equipment upgrades only when the existing equipment fails and consider cost as a primary decision-making factor. Thus, these building operators are unlikely to opt for high efficiency equipment over standard efficiency models in emergency replacement situations; these decisions have 20-year implications and represent a lost opportunity to capture viable energy savings.

In buildings where 80% of tenants are income qualified (i.e., meet the 80-20 rule), we can assume that any ESA Program funds invested in central system upgrades in buildings where tenants pay their utility costs (or electricity and gas are included in the rent) would be consistent with existing program rules, produce tenant benefits and provide additional savings for the IOUs. Investments in brighter, safer hallway and parking lot lighting also contribute to tenant health, safety and quality of life, all objectives of the ESA Program.

The IOUs could consider offering incentives for common area and central system upgrades through the ESA Program under two possible conditions:

1. In low-income multifamily properties that qualify for whole-building shell upgrades currently under the 80-20 rule, and
2. In buildings where individual households that pay their own electricity and gas bills (or these costs are included in the rent) rely on central heating and/or cooling systems. Under these conditions, improvements made to central heating and cooling systems accrue directly to the tenants in the building and benefits are consistent with the ESA Program's mission.

Common area lighting measures are generally cost effective, as are some typical common-area direct installation measures (e.g., exit signs, vending machine controllers). These could be offered through a delivery mechanism, consistent with the MFEER program, for qualifying ESA Program buildings (possibly through pooled MFEER and ESA funding).

Through a building assessment that includes estimating the costs and savings of potential upgrades, the program can investigate the cost-effectiveness of installing larger measures such as central heating and cooling system upgrades. In cases where the building meets the qualification for central system

upgrades and the assessment finds upgrades to be cost-effective, the ESA program could offer incentives covering incremental costs of upgrading to higher efficiency equipment (above standard efficiency required by codes or standards).

In addition, the IOUs can offer support to identify and apply for available financing opportunities. As discussed in Section 7, there are a number of options available and the market is changing quickly. (A designated contact person, such as the single point of contact, who is aware of these and other options could guide building owners to appropriate financing.)

To help manage overall program costs and capture 20-year savings opportunities, we recommend offering central system incentives that cover the full incremental cost of high efficiency equipment when building owners are replacing failed equipment.

Typically, different contractors offer lighting and HVAC services. Common area measures could be offered in a staged approach, with direct install measures installed at the time of the assessment and larger measures installed at a later time. High efficiency lighting equipment could be installed while the building owner and contractor research the costs and feasibility of HVAC measures. A single point of contact approach could facilitate this research and work with the building owner to design a phased approach that best supports their needs.

(Relevant findings, including estimated costs to support this recommendation are provided under conclusion statements 2 and 4.)

3. ***Research building recapitalization cycles to inform marketing strategies that target building owners.***

The IOUs could consider investigating and investing in a research strategy to identify buildings that are planning major recapitalization events to facilitate targeted, direct outreach to appropriate property owners. Our research findings indicate that a significant portion of buildings that conduct major building rehabilitation projects are those that qualify for housing subsidy programs. We estimate approximately 18,000 buildings fall into this category. Market rate housing may or may not undergo a comparable investment cycle.

Working with subsidized housing agencies can identify properties slated for recapitalization or other investments. The IOUs could develop a system to receive notice about buildings planning recapitalization through the Low Income Housing Tax Credit (LIHTC) administered by the State Treasurer's office. This information could help the IOUs to work closely with multifamily building owners to reach eligible low income customers. This is one area where information appears to be readily available and no regulatory changes are needed.

Research can be conducted to determine where (market rate and/or subsidized) building vintages indicate an upcoming need for upgrades, supported by building permit and land use data to identify an approximate schedule of upgrades. The IOUs may also wish to coordinate with banks and lenders that

are active in (low-income) multifamily property investment to develop communication strategies that might help inform targeted outreach and schedules.

As major building rehabilitation projects would likely benefit from a whole-building approach, we recommend that ESA Program staff work closely with the EUC MF program to develop a plan for implementing this strategy. Using an integrated implementation approach will further enable ESA and EUC MF to provide services that benefit low-income tenants while producing significant energy savings.

Because building recapitalization events are likely infrequent and irregular, the Cadmus team recommends using this research to conduct targeted, in person outreach, rather than developing general marketing messages and materials.

(Relevant findings to support this recommendation are provided under conclusion statement 10.)

4. Identify options for integrating the ESA Program with MFEER and/or EUC MF to create a comprehensive project path for multifamily building owners.

Some strategies advocated by the Commission in Decision 12-08-044 and multiple findings in our research point to the need for better coordination between the suite of California's programs serving multifamily buildings and a higher level of technical and administrative support. Creating low-income incentives within the existing market rate multifamily programs coupled with a higher level of program integration and technical support would effectively enable the ESA Program to offer comprehensive services for low-income multifamily buildings. Potential advantages of using a more integrated approach include filling the gap in the existing California programs by encouraging central system and common area upgrades in low-income multifamily buildings, maximizing energy savings in buildings that qualify for larger upgrades, providing healthier and safer buildings for low-income tenants, and mitigating energy cost increases to building operating expenses. Also, a whole-building implementation path could be offered specifically for low-income multifamily properties within the existing MFEER and/or EUC MF programs. [117]

Early results from the EUC MF program's first year of implementation in PG&E's territory indicate that there is interest among low-income multifamily building owners and operators in installing more comprehensive building upgrades, as nine participants in the pilot phase of the program are deed restricted buildings.

[117] The net impact on employment resulting from adding a whole building option to the current low-income multifamily program landscape is not clear. Contractors currently focused on recruiting and treating ESA Program participants at a unit level would continue to be needed.

Implementing this recommendation will require careful consideration of several key features:

- Delivering broader building wide energy efficiency services will require enabling low-income multifamily buildings to participate in the more comprehensive audit processes offered through MFEER and EUC MF as a key first step to ensure that all available *cost-effective* upgrade opportunities are captured. The MFEER program offers two tiers of building assessment with different levels of rigor based on the building type and property owner or managers' project objectives. EUC MF also provides a comprehensive, whole-building assessment at a cost to the program of $5,000 to $10,000 per building depending on building size, as shown in Table 70.

Table 70. Building Assessment Cost Estimate

Service/Measure	Specification	Incremental Cost
Whole building assessment*	5-20 units	$5,000
	21 -100 units	$10,000

* In EUC MF, a $5,000 incentive is offered for building assessments in properties with 5-20 units (SoCal REN) or 5-30 units (PG&E); and a $10,000 incentive for assessments in properties with 21-50 units (SoCal REN) or 31-100 units (PG&E). See Table 59.

- The building owners and operators will need to be treated as the program participant since they have the decision making authority for expenditures and measures installed. This approach will entail adopting a marketing strategy that targets building owners and operators and aligns messaging with the benefits of building upgrades from an investment perspective.
- To support a multi-program implementation approach, the IOUs should implement a new role for a program-wide intake contractor or internal program staff to screen potential building owner and tenant participants, and to help them determine which program(s) may be best suited to meet their individual needs and the participation approach that offers the greatest benefit. The IOUs have already begun efforts to implement a higher level of technical support through a single point of contact in the MF EUC program. In a more integrated multi-program delivery strategy, expanding the role of this single point of contact to include broad services across programs with support for all building segments (including for low-income multifamily buildings) could serve several functions.

  The single point of contact's responsibilities may include supporting participants to: [118]
  - Navigate the various program options available to them based on eligibility criteria and their likely approach to upgrading the building;
  - Complete the income verification and application processes;

[118] The discussion of the comparison programs noted the single point of contact typically plays a somewhat broader role than proposed here. In the comparison programs, the contact person also typically provides technical support in conducting or reviewing the assessment, helping to define the scope of work, helping to evaluate contractor bids, and overseeing installation. In the MF EUC plans, a HERS rater, who is separate from the SPOC typically takes on this technical function. The contact persons for some of the comparison programs are also knowledgeable about the financing options for retrofits available to building owners.

- Identify and apply for available financing options; and
- Select qualified installation contractors.

The multifamily programs could pool their resources to provide this level of intake and technical support services through a third party contractor, state agency, or internal program staff – —spreading the cost across the programs targeting multifamily buildings and minimizing the potential competition between them.

In this scenario, it will be important to structure the single point of contact as a "program-neutral" feature, whereby technical support does not emphasize one program's offering over another.[119]

To specifically address the capital constraints common for low-income buildings, the IOUs could provide larger incentives for low-income multifamily buildings treated through MFEER and EUC. Each program offers measures and an incentive structure that is well suited to multifamily housing; however, higher incentives may be needed to help overcome cost barriers prevalent in low-income multifamily housing. The need for these buildings to receive higher incentives does not come from the personal incomes of the owners but from the market they serve. That is, there is less opportunity for these owners to increase rents to cover the costs of upgrades or to market their building as "green," which effectively makes retrofits more costly and requires higher incentives.

Consider the following:

- Offer free direct installation measures for multifamily building common areas, consistent with measures provided by MFEER and EUC MF during the comprehensive assessment phase.
- Prescriptive incentives offered through the MFEER program should be analyzed to determine whether higher incentive levels are needed to overcome cost barriers in the low-income segment. Incentives for cost effective measures such as common area lighting could be designed to cover the full project cost. Incentives for large upgrades such as central heating and cooling system replacements could be designed to cover the full incremental cost and offered to building owners replacing equipment at the end of its useful life.
- Custom incentives for whole building upgrades offered through the EUC MF program could offer either a higher performance based incentive to overcome low-income cost barriers, or a per-unit adder based on the number of verified low-income tenant units in the building. As

[119] As stated in the Commission Decision 12-08-044 Section 3.10.6.4, the study shall "Review and investigate coordination concerns related to any new delivery methods that streamline the ESA process with external financing and energy efficiency options such as how a single point of contact will be responsible for coordinating IOU-administered energy efficiency, renewable, incentive, and financing programs as well as non-IOU-administered, external multifamily efficiency, renewable, incentive, and finance programs in California."

in the comparative programs examined, the adder could be contingent upon installation of all cost effective measures in each apartment unit. [120]

- To facilitate consideration of this recommendation, we provide some information on the estimated costs of installing common area and central system measures on a per building basis in Table 61. As the EUC MF program continues to evolve, it is likely to provide useful data on potential program costs and benefits that could be expected from implementation of these strategies.
- To streamline delivery among the various available multifamily programmatic options, the IOUs should consider methods to synchronize the program's policies and procedures related to installation contractors. This could include developing consistent contractor qualification protocols, a single application process across all multifamily programs, using similar contractor participation requirements, providing contractor training that touches all programs, and using analogous quality control procedures.

We understand that this recommendation entails expanding the offering currently available to ESA participants beyond the tenant-focused approach and addressing low-income customers' needs at a building level. Further, this recommendation likely will require an institutional change to the ESA Program and Commission involvement. However, it is important to note that adopting a whole building strategy will have these results:

1. It will benefits low-income tenants by increasing the comfort and safety of the building as a whole and by mitigating building operating costs which can help mitigate potential rent increases; in some cases, upgrades may reduce tenant utility costs directly.
2. It is consistent with direction provided via the Commission, in the California Long-Term Energy Efficiency Strategic Plan and in Decision 08-11-031 that the ESA program must evolve into a resource program that garners "significant energy savings" while providing an improved quality of life for California's low-income population and with the ALJ's recommended Strategies 3, 4, and 5 which suggest a desire for the ESA Program to work more directly with multifamily building owners and managers and provide a more comprehensive whole-building energy assessment by better leveraging other existing multifamily programs.[121]

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[120] Installing all cost effective measures within a tenant unit as a condition of the receiving the adder, and/or not raising rents, may be challenging to enforce. However, one jurisdiction reported that as part of tenant's energy education, the tenant is informed the landlord agreed not to raise rents. The jurisdiction follows up with building owners after tracking a year of post-retrofit billing data to discuss how the owner is using the cost savings. If the building owner does not comply, they are not eligible for future program (many participants have multiple buildings). Some building owners have had to pay back the incentives they received when they sell the building to someone who will not keep the rent affordable.

[121] California Public Utilities Commission Decision 12-08-044. August 23, 2012. Section 3.10.6.3.

In consideration of this recommendation, it will be important for the IOUs and the Commission to carefully weigh the potential costs and benefits to each program, funding allocations, impacts on the programs' overall cost-effectiveness, logistics and program delivery constraints, and feasibility.

(End of Volume 1)

ATTACHMENT

ESA MULTIFAMILY SEGMENT STUDY

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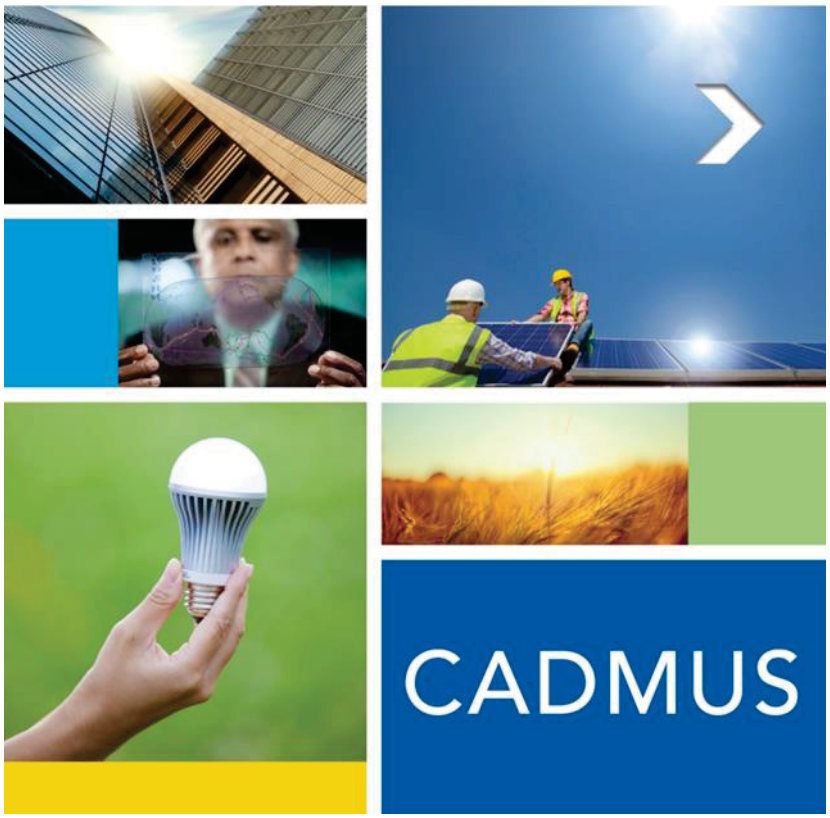

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ESA Program
Multifamily Segment Study
Volume 2: Appendices

December 4, 2013

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Appendix A. Decision 12-08-044 References and Multifamily Segment Study Activities

Background

On August 23, 2012 the California Public Utilities Commission approved Decision (D.) 12-08-044 and approved Energy Savings Assistance (ESA) and California Alternate Rates for Energy (CARE) Programs' activities and budgets of the investor-owned utilities (IOUs) for the 2012-2014 program cycle. As detailed in the California Strategic Plan for Energy Efficiency, the Commission's vision is that, by December 31, 2020, all eligible low-income electricity and gas customers are given the opportunity to participate in low-income energy efficiency programs. In Decision 12-08-044, the Commission recognized the need to enhance penetration in the multifamily segment in order to achieve that objective.

The Commission directed the IOUs to begin developing and advancing more long term and comprehensive multifamily segment strategies. As the first prong of a parallel, two-pronged approach, the IOUs were directed to immediately begin improving their penetration of the multifamily segment of the low-income population, with the eight immediate Multifamily Segment Strategies, including additional measure offerings. The second part and complementary part of this parallel, two-pronged approach, the Commission directed the IOUs to contract a consultant to pursue a Multifamily Segment Study.

Multifamily Segment Study Activities

The study's goal was to develop an understanding of the low-income multifamily market to provide data that will help California IOUs develop and advance short- and long-term plans to meet the needs of low-income tenants living in multifamily housing. The ESA Program Multifamily Segment Study envisioned by the Commission in D.12-08-044 and by project administrators includes the following activities.

1. Gather data on the state's multifamily housing stock and ownership profiles, including a statewide demographic and programmatic assessment of California's low-income multifamily housing stock (by each IOU territory and by county).
2. Catalogue multifamily energy-efficiency programs (particularly those for low-income customers), including Commission programs and those administered by other government agencies, utilities and organizations within the state of California, as well as the most successful and/or effective recent and ongoing multifamily energy-efficiency programs benefitting low-income customers administered in other jurisdictions across the country.
3. Evaluate and further examine proposals from parties to the ESA Program proceeding (A.11-05-017 et al.) in the context of previous ESA Program decisions, the current Commission directions (including the Spring 2011 Energy Division staff guidelines for a Multifamily Pilot), and the EE Strategic Plan.
4. Review the Commission's other existing multifamily programs within the overall context of the ESA Program, and recognizing that multiple income levels may reside in any individual building.

5. Review other recently completed multifamily projects and pilots benefitting low-income residents performed under other state programs.
6. Propose (and possibly conduct) field studies, as needed.
7. Review and investigate the cost and budget implications of one or more approaches to low-income multifamily program implementation, including consideration of possible new cost-sharing arrangements and/or financing mechanisms that might be applied.
8. Review and investigate coordination concerns related to any new delivery methods that streamline the ESA Program process with non-IOU financing and energy-efficiency options such as how a single point of contact could be responsible for coordinating a) IOU-administered low-income, energy-efficiency, renewable, incentive, and financing programs, as well as b) non-IOU-administered, external multifamily efficiency, low-income, renewable, and housing improvement incentive or finance programs in California.
9. Identify available low-income and energy-efficiency financing options, and develop a funding and implementation schema utilizing the variety of energy-efficiency programs available for each multifamily housing owner/operator profile.
10. Develop overall recommendations for multifamily strategies looking toward the 2020 vision for the ESA Program of 100% penetration of eligible and willing low-income customers.
11. Hold a minimum of one to three public meetings to obtain, document, review and consider all stakeholders' input.

Decision 12-08-044 References

The following passages in Decision 12-08-044 are frequently referenced throughout this study:

Table 1. Decision 12-08-044 Passages

Page	Text
3	We realize that while the ESA Program is a low-income program that contributes to the quality of life of low-income communities, we confirm that, at its core, it is an energy efficiency program. Thus, the program must be directed, administered and delivered in a manner so as to yield significant energy savings. To achieve optimal energy savings, the ESA Program must be administered cost- effectively to yield maximum energy savings at reasonable costs.
4-5	Particularly in these challenging economic times, we must remain steadfast in our vision and remind ourselves of the vision that the Commission adopted for the low-income communities in our Strategic Plan that "By 2020, 100 percent of eligible and willing customers will have received all cost-effective [Energy Savings Assistance Program] … measures."8 This vision was also echoed and codified by the legislature.9 To realize that vision, Strategic Plan sets these goals for the ESA Program: • By 2020, all eligible customers will be given the opportunity to participate in the ESA Program. • The ESA Program will be an energy resource by delivering increasingly cost-effective and longer-term savings.

Page	Text
19	The ESA Program has also been designed to provide an improved quality of life for the low-income population by delivering no-cost home weatherization services and efficiency measures to low-income households to help: (1) conserve energy; (2) reduce their energy costs; and (3) improve their health, comfort, and safety. Installing no-cost energy efficiency measures helps those customers reduce their energy consumption by delivering energy savings while also producing bill savings and reduced energy consumption.
122	In D.08-11-031,70 the Commission rejected the IOUs' proposal to eliminate the 3MM Rule and instead modified the 3MM Rule by creating an exception in response to those concerns to allow the IOUs to treat home needing less than three measures, "as long as the total energy savings achieved by either measure or measures combined yield(s) energy savings of at least either 125 kilowatt-hours (kWh)/annually or 25 therms/annually." As a result, that 3MM Rule then evolved to what we have come to refer to today as the "modified 3 Measure Minimum" or the modified 3MM Rule.
157	As the first of this parallel, two-pronged approach, the IOUs are directed to immediately roll out the eight Multifamily Segment Strategies described below, including additional approved measure offerings to multifamily households we approve in this decision specifically to enhance penetration of this segment.
164	As the second part of a parallel, two-pronged multifamily segment approach, the IOUs are directed to begin developing and advancing more long- term and comprehensive multifamily segment strategies as outlined below. The IOUs are directed to pursue a Multifamily Segment Study ordered in this decision below.
264-265	The IOUs have proposed increases in their 2012-2014 Applications from 5% to 15% (19% in the case of SoCalGas). Most of the parties oppose the IOUs' proposed increase and support the current 5% unwillingness factor adopted in D.08-11-031 which is consistent with 2007 KEMA report findings. Additional information and evidence is required in order to determine whether the increase proposed by the IOUs is reasonable. The IOUs are directed to track and report customer unwilling/unable percentages during the 2012-2014 budget cycle. In addition, the IOUs are directed to document the reasons why customers are unwilling and/or unable to participate in the program during the 2012-2014 program cycle. This information will be evaluated to determine the reasonableness of the IOU's joint proposal to increase the unwillingness factor for future program cycles. Therefore, the Commission rejects the IOUs proposed increases of the unwillingness factor and require that current 5% unwillingness factor continue be used for 2012-2014.

Eight Multifamily Segment Strategies

The commission directed the IOUs to take a two pronged approach with the multifamily section. The eight strategies discussed in the Decision, page 157 (as referenced in the preceding table) include the following and are provided here for reference. Note that examination of these eight strategies or determining whether the steps were successful in reaching the multifamily segment were outside the scope of the Multifamily Segment Study.

Strategy 1 – Whole Neighborhood Approach

Strategy 2 – Property Owner Waiver Update

Strategy 3 – Updated Marketing Approach to Multifamily Homes

Strategy 4 – EUC/MIDI/MFEER Coordination

Strategy 5 – Single Point of Contact

Strategy 6 – Same Day Enrollment, Assessment, and Installation

Strategy 7 – Streamline Practice and Service Delivery

Strategy 8 – Providing Feasible Measures for Multifamily Segment Including Retention of Certain Measures Proposed for Retirement for Program Cycle 2012-2014

Appendix B. Stakeholder Comments on Decision 12-08-044

The comments, proposed changes, and recommendations on Decision 12-08-044 from parties to the proceedings provided important context for the findings of this study. By understanding the issues and concerns raised by stakeholders, a more robust exploration of the multifamily segment was conducted. This information contributed to the development of key considerations for the study's findings and conclusions.

Table 2. Comments on Decision 12-08-044 Posted by Stakeholders on CPUC Website from 10/31/11 to 1/9/13

Stakeholder Group	Number of Comments
Association of California Community and Energy Services	5
Black Economic Council	3
Brightline Defense Project	1
California Housing Partnership Corporation	2
California Large Energy Consumers Association	1
California Public Utilities Commission, Division of Ratepayer Advocates	3
Center for Accessible Technology	3
Energy Efficiency Council	3
Green For All	2
La Cooperativa de Campesina	4
Latino Business Chamber of Greater Los Angeles	3
Maravilla Foundation	5
National Asian American Coalition	3
National Consumer Law Center	2
National Housing Law Project	1
Natural Resources Defense Council	2
Niagara Conservation Corporation	1
Opower	1
Pacific Gas & Electric Company	4
San Diego Gas & Electric Company	7
Southern California Edison Company	8
Southern California Gas Company	7
The East Los Angeles Community Union (TELACU)	5
The Energy Efficiency Council	1
The Greenlining Institute	3
The Utility Reform Network	4

Table 3. Prevalence of Stakeholder Support for Key Proposals and Strategies from Decision 12-08-044, Section 3.10.1-3.10.5.6

Proposal	Number of Supporters
Establish “Single Point of Contact”	14
Assistance to MF owners for central heat & hot water systems (like HUD-DOE/WAP)	12
Full integration of ESAP with other EE Programs (MIDI/EUC/MFEER)	10
MF segment underserved; barriers to entry in ESA for MF	10
"Expedited Enrollment" or "Categorical Eligibility"	8
Adopt whole house, performance-based approach	8
TELACU multi-phase pilot	8
Updated marketing approach to MF homes	7
Value of housing subsidies not counted as income	6
Model successful low-income MF EE programs in other states	4
Simplify Owner Authorization (Property Owner Waiver) forms; coordinate across IOUs	2
Make ESA Program "Neighborhood Approach" more effective	1
No "carve out" of funds for investors/owners of deed restricted MF	2
Set per unit and per building Caps on ESA program assistance	1

Appendix C. Estimation of the Distribution of Low-Income Multifamily Housing

Methodology

To develop an estimate of the number and distribution of LIMF housing units in California, Cadmus combined two sources of information: American Community Survey (ACS) 5-year summary data and Public Use Microdata Sample (PUMS).

Available as pre-defined tables at the census-tract level, ACS summary data is a compilation of the number of people, housing units, multifamily housing units, and households within a relatively small geographic area for a five-year period. However, these data cannot be used directly to estimate the intersection between low-income households and households that live in multifamily buildings. Tabulating this intersection entails estimating census-tract households using Public Use Microdata Sample (PUMS) proportions.

PUMS data are an aggregation of ACS data over a three-year period. Unlike the five-year census tract data, the three-year PUMS data can be directly manipulated as individual household records. However, these data are identifiable only for a larger geographic area, the Public Use Microdata Area (PUMA). This restriction is imposed to ensure the confidentiality of respondents. (Whereas a census tract may comprise as few as 2,000 residents, a PUMA comprises approximately 100,000 residents.)

For each PUMA, Cadmus calculated the percentage of households that: (1) met the ESA Program low-income criterion of earning less than or equal to 200% of the federal poverty guideline (defined by the U.S. Census Bureau), and (2) resided in buildings with five or more units. Our approach was as follows:

Using poverty thresholds defined by the U.S. Census Bureau, we identified upper-limit incomes for households of different sizes. Households with an income equal to or less than 200% of the value specified in federal poverty guideline were classified as low-income. (This is consistent with the definition used for qualification in the CARE and ESA Programs.) Note that we used 2011 poverty thresholds, because the ACS data we used to estimate the number of low-income multifamily households was for the years 2009 to 2011. The dataset contains a multiplier to allow estimation of dollar amounts in 2011 dollars.

We then counted the number of households meeting both multifamily and low-income criteria for each PUMA. This value was divided by the total number of multifamily households within that PUMA to obtain the percentage of multifamily households at or below 200% of the federal poverty guideline. This percentage represents the conditional probability that a household meets the multifamily criterion, given that it is a multifamily household. We excluded records for group or institutional quarters.

For defining 200% of the federal poverty guideline, Cadmus used the *weighted average* thresholds employed by the Department of Health and Human Services (HHS). As these have one distinct value for each number of residents within a family unit, they are the thresholds we adopted for our research. These are also the thresholds used for the ESA Program. The full set of Census thresholds has different threshold values, depending on the number of householders who are children (see Table 4).

Table 4. Poverty Thresholds for 2011 by Size of Family

Size of Family Unit by Number of Occupants	Weighted Average Thresholds
One person (unrelated individual)	11,484
Two people	14,657
Three people	17,916
Four people	23,021
Five people	27,251
Six people	30,847
Seven people	35,085
Eight people	39,064
Nine people or more	46,572

Source: U.S. Census Bureau

The ACS five-year data summaries provide counts by the number of housing units in a building. There are also summaries of the number of people at each level in the income-to-poverty index. However, because these data are available only in pre-populated summaries, it is not possible to map these counts of people to the counts of households.

For the 2011 U.S. Census data, census tracts are not nested within PUMAs. Cadmus estimated[1] the percentage of each census tract overlapped by a PUMA and used this proportion to adjust the population counts.[2] Next, we multiplied these proportions—and the PUMA-level conditional probabilities—by the census-tract level counts of multifamily households. We also accounted for unoccupied units by deflating the number of units by the ratio of occupied units to total housing units, and we applied a factor to account for the difference between single-family and multifamily occupancy rates. We summed these results for each census tract to obtain the number of low-income, multifamily households within that tract.

For example, consider a census tract that has 100 multifamily households *and* this tract is split in half by two PUMAS. If low-income multifamily households comprise 20% of one PUMA and 10% of the other, then the estimate of low-income multifamily households would be calculated as follows:

[1] Using ArcGIS' "Union" tool. All data were projected to NAD_1983_Calfornia_Teale_Albers.

[2] Assumes uniform distribution of population. Dasymetric mapping was outside the scope of this analysis.

$$\left(50\%_{area} * 20\%_{low\ income} * 100_{multifamily}\right) + \left(50\%_{area} * 10\%_{low\ income} * 100_{multifamily}\right) = 15_{low\ income\ multifamily\ households}$$

More than 99.9% of low-income multifamily households in California have electric service; however only 87% of low-income multifamily households in California use gas fuel in their home. Where we needed to estimate the number of low-income multifamily *gas customers* we applied an adjustment to the number of low-income multifamily households, based on data from the 2011 AHS. For each census tract within an MSA covered by the AHS, we multiplied the number of low-income multifamily households by the proportion of low-income multifamily households within that MSA who have gas service (excluding bottled gas). For households outside of an MSA, we applied the statewide average.

Distribution by County

Cadmus estimated the distribution of low-income multifamily households by California county as well as additional population statistics that are relevant to this study. We used Census Bureau definitions of housing units and households; the difference in counts between the two primarily reflects the number of unoccupied housing units. Households include both families and unrelated people but households always refer to people in occupied units. Table 5 shows these estimated population statistics. We have also indicated where a county is included within a Metropolitan Statistical Area (MSA). We present findings by MSA in the section "Characteristics of Low-Income Multifamily Housing in California." Statewide, low-income multifamily households comprise 9.4% of all households and 42.3% of multifamily households. Note that the number of households was derived from census data. These will be somewhat different than the number of households receiving services from the IOU in any given county.

Table 5. Estimated Population Statistics for California Counties

County	MSA Reference Number	County Population	Housing Units	Households	Multifamily Households	Low-Income Multifamily Households
Alameda	5775	1,494,876	580,725	536,160	138,813	50,946
Alpine		1,167	1,772	357	126	78
Amador		38,244	17,943	14,283	465	288
Butte		219,309	95,589	85,219	8,891	5,495
Calaveras		45,794	27,823	18,865	385	238
Colusa		21,297	7,850	6,989	542	404
Contra Costa	5775	1,037,817	398,915	370,925	59,442	20,682
Del Norte		28,561	11,150	9,818	718	440
El Dorado	6920	179,878	87,571	68,812	4,184	1,982
Fresno		920,623	313,355	285,338	43,526	26,731
Glenn		28,027	10,764	9,483	490	365
Humboldt		133,585	61,293	53,724	4,998	3,157
Imperial		171,343	55,668	48,117	6,449	4,894

County	MSA Reference Number	County Population	Housing Units	Households	Multifamily Households	Low-Income Multifamily Households
Inyo		18,457	9,457	7,910	462	286
Kern		829,254	282,009	250,999	21,364	13,272
Kings		152,335	43,533	40,716	3,959	2,156
Lake		64,392	35,441	25,654	1,286	896
Lassen		35,001	12,716	10,097	901	552
Los Angeles	4480	9,787,747	3,437,584	3,218,518	1,054,616	460,350
Madera		149,611	49,012	42,032	2,084	1,594
Marin	7360	250,666	110,937	102,832	19,841	6,835
Mariposa		18,290	10,142	7,607	123	76
Mendocino		87,525	40,185	34,102	2,573	1,793
Merced		253,606	83,584	74,079	6,277	4,663
Modoc		9,587	5,174	3,947	120	74
Mono		14,016	13,876	5,416	1,411	873
Monterey		411,385	138,925	125,217	21,937	10,695
Napa		135,377	54,612	49,640	6,083	3,079
Nevada		98,392	52,304	41,561	2,177	1,499
Orange	0360	2,989,948	1,046,323	987,164	238,521	88,527
Placer	6920	343,554	151,245	130,736	14,392	5,966
Plumas		20,192	15,501	9,434	488	336
Riverside	6780	2,154,844	794,478	672,896	75,669	41,218
Sacramento	6920	1,408,480	554,374	510,976	93,095	46,367
San Benito	7400	54,873	17,855	16,785	772	490
San Bernardino	6780	2,023,452	696,776	598,822	78,148	39,476
San Diego	7320	3,060,849	1,160,784	1,064,048	290,378	112,680
San Francisco	7360	797,983	374,919	338,366	146,922	45,268
San Joaquin		680,277	232,843	212,902	25,167	15,094
San Luis Obispo		267,871	116,925	101,993	10,942	6,145
San Mateo	7360	711,622	270,614	256,423	64,867	16,258
Santa Barbara		419,793	152,684	141,635	27,537	13,519
Santa Clara	7400	1,762,754	629,448	599,652	146,472	44,110
Santa Cruz		259,402	104,278	93,834	11,248	5,617
Shasta		177,231	77,092	69,147	6,049	3,994
Sierra		3,277	2,307	1,328	44	30
Siskiyou		44,687	23,886	19,782	1,549	950
Solano		411,620	152,239	139,312	19,204	8,790
Sonoma		478,551	203,847	184,170	23,364	9,977
Stanislaus		512,469	178,850	164,933	16,014	9,917

County	MSA Reference Number	County Population	Housing Units	Households	Multifamily Households	Low-Income Multifamily Households
Sutter		94,192	33,755	31,668	4,106	2,552
Tehama		62,985	26,912	23,810	1,649	1,228
Trinity		13,711	8,650	5,731	139	104
Tulare		436,234	140,519	128,324	8,371	5,861
Tuolumne		55,736	31,157	22,157	1,314	813
Ventura		815,745	280,758	264,982	38,455	15,441
Yolo	6920	198,889	74,639	69,860	14,979	8,804
Yuba		71,817	27,562	23,885	2,214	1,376
Statewide		36,969,200	13,631,129	12,433,172	2,776,312	1,175,301

Comparison With Previous Findings of the 2009 RASS

Cadmus compared the estimates developed for this research to estimates of households (and, specifically to estimates of multifamily households) that were produced for other recent studies, including the 2009 Residential Appliance Saturation Survey (RASS).

When we compared the ACS-based estimates of total population with the estimates developed for the 2009 RASS, we found systematic differences in both the number of households and the number of multifamily households.[3] As RASS is based on a sample of residential electric utility customers, we compared the RASS estimates for three electric utilities to the ACS-based estimates for the same utility territories (see Table 6).

Table 6. Comparison of 2011 ACS to 2009 RASS Estimate of Households and Low-Income Households

Utility	ACS Households	RASS Households	ACS/RASS Households	ACS Multifamily Households	RASS Multifamily Households	ACS/RASS Multifamily Households
PG&E Electric	4,263,939	4,634,081	92%	790,156	728,996	108%
SDG&E Electric	1,169,705	1,230,071	95%	308,055	278,170	111%
SCE Electric	4,115,093	4,371,616	94%	789,022	705,027	112%

Although the ACS-based estimates show from 5% to 8% fewer total households, the estimates also show from 8% to 12% more multifamily households than the RASS. Given the large sample size on which the two estimates are based, these are sizeable differences that cannot be the result of sampling error alone.

[3] Palmgren et al. 2010. "2009 California Residential Appliance Saturation Study." Prepared for the California Energy Commission: Kema, Inc CEC-200-2010-004. http://www.energy.ca.gov/appliances/rass/

As large and sophisticated as the sample was for RASS, the ACS data have a distinct advantage in terms of both sample size and response rate. The RASS is based on a very large mail survey administered to utility customers (see Palmgren et al., 2010, for a complete methodological report on the RASS). The RASS data consist of responses from 25,721 households, and the response rate across all sampling strata was 18%. The RASS methodology employed post-weighting of results, but the weights were applied relative to the utility populations. There is no indication that RASS results were post-weighted to make them consistent with census data.

The 2011 three-year ACS data used in Cadmus' estimate consist of records for 544,878 housing units. The response rate for the ACS survey is greater than 97.5% across the three years in the sample. Thus, the opportunity for non-response bias is much smaller for the ACS data than for the RASS. However, when the numbers for the IOU territories (based on ACS data) are compared with RASS data, the result requires a spatial allocation of households. Thus, where utility territories bisect a census tract, we allocate households based on the proportion of the tract within the utility territory. While this results in some error in our estimates by utility territory, we find no indication that this approach introduces a systematic bias. Our estimates for counties, however, do not include any such source of error because census tracts nest perfectly within county boundaries, so there is no need for proportional allocation.

We conclude from this comparison that the RASS dataset over-estimated the number of single-family households and under-estimated the number of multifamily households.

Comparison With Previous Findings of Athens Research

Cadmus developed an estimate of low-income *multifamily* households within census tracts by projecting the proportion of low-income multifamily households at the PUMA onto the number of multifamily households in each tract. We did not independently estimate for each census tract the number of low-income households across all housing types. Where we needed this information as a point of comparison, we drew upon data from Athens Research (2012) on the proportion of total households that are low-income. Athens' estimates of low-income households derive in much the same way as those of the Cadmus team, based on ACS data. Athens provided the team with estimates for each county, including an estimate of the proportion low-income households among all households and an estimate for each utility's customer base within the county.

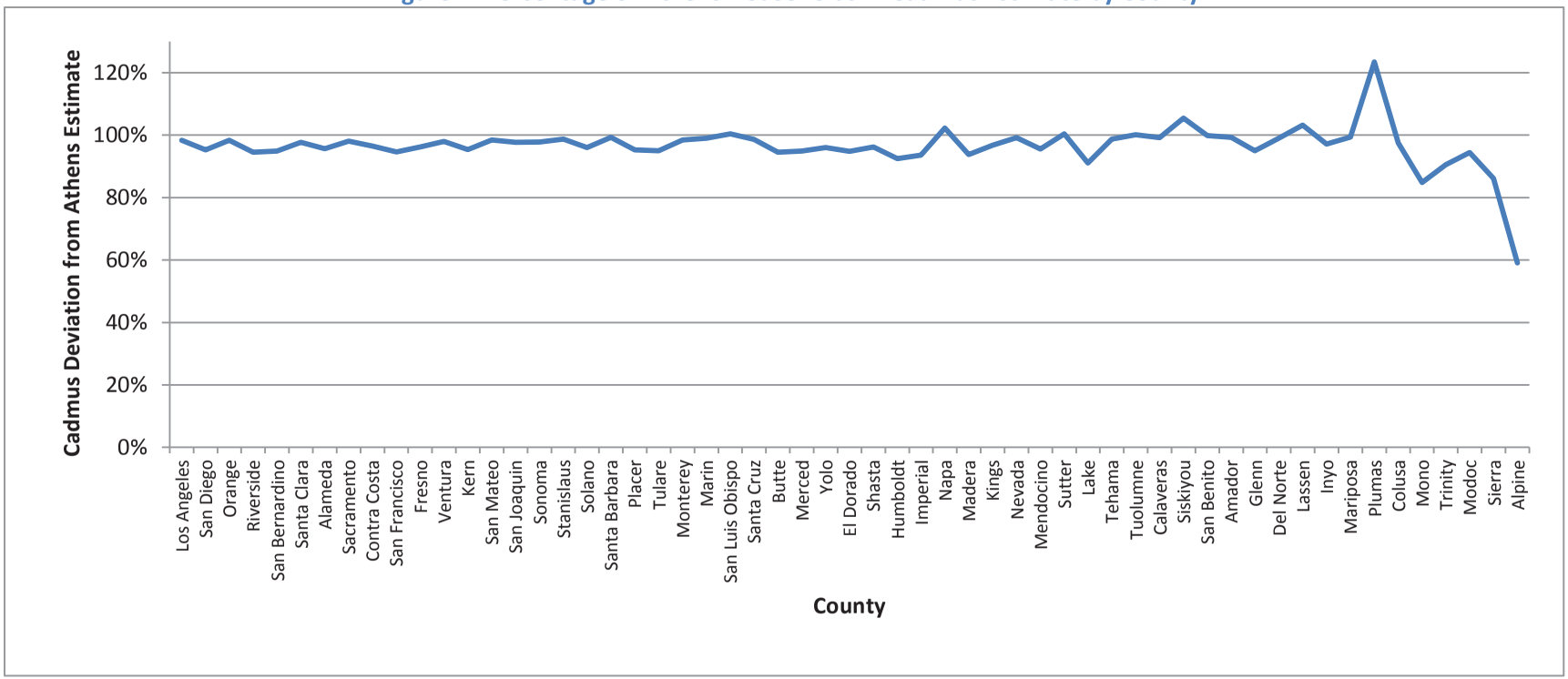
For low-income estimates at the county level we applied Athens percentages to the Cadmus estimate of households. The proportions were multiplied by the number of households within the county to arrive at an estimate of the number of low-income households.

Figure 1 shows the percent of households identified by Cadmus compared to the Athens estimate, in order of total number of households per county. For counties where the two estimates were exactly equal, the value would be 100%. Where the line falls below the 100% line, Cadmus estimates fewer households than Athens; where it is above 100%, Cadmus estimates more households than Athens. Among populous counties, the line tracks just below the 100% line. In counties below 15,000 households, the ratio of estimated becomes less stable; but since these counties are small, and some

are not even served by the IOUs, the difference in absolute terms is not substantial. Overall, Cadmus identifies a number of California households that is 97% of the Athens estimate.

Cadmus believes at least part of this difference results from a difference in methodology between Cadmus and Athens. Athens factors into their estimate the number of utility accounts based on customer information system data from each utility. If there are any instances of empty units counted in the total of households, or if there are multiple accounts assigned to the same household that have not been completely removed from the CIS data, the Athens estimate will be slightly inflated. Overall, however, we consider a 3% difference in the count of households to be a good rate of consistency between the two estimates.

Figure 1. Percentage of Athens Households in Cadmus Estimate by County



Source: U.S. Census Bureau American Community Survey 2011 and 2012 Athens Research

Appendix D. Estimation of the Characteristics of Low-Income Multifamily Housing

Overview

Cadmus' characterization of low-income multifamily housing in California is derived primarily from the 2011 American Housing Survey (AHS) Public Use File. The AHS is sponsored by the Department of Housing and Urban Development (HUD) and conducted by the U.S. Census Bureau. These data provide much greater detail about housing characteristics than are found in the ACS and, thus, provide a key source of information about the circumstances of our target class of households, LIMF.

The AHS is a longitudinal survey of housing units, with data collected from the same units every two years and augmented by including additional households in the survey and special topics in each cycle. Before 2007, the AHS consisted of two surveys—a national survey and a metropolitan area survey—each of which was conducted in alternating years. In 2007, however, the two surveys were conducted concurrently, although the results were not intended to be combined.

For the 2011 survey, the national and metropolitan samples were combined, with an especially large oversample of households from 29 metropolitan areas. For instance, in 2009, there were 8,432 housing units represented in the 29 metropolitan areas; in the 2011 data, there are 119,593 units, which is a 14-fold increase.

For the 2011 survey, the Census Bureau calculated survey weights based on the 2010 decennial census, in an effort to align the survey responses with the most comprehensive information available. These weights provide a benchmark for estimating the total number of households in the AHS sample. In this report, except where indicated, the percentages and frequencies reflect weighted data.

The data Cadmus used are organized into Metropolitan Statistical Areas (MSAs). These contiguous geographic areas of population and commerce are defined by the Office of Management and Budget. A typical MSA is defined by a single city that wields substantial influence over the region and, while MSAs are often defined by county boundaries, they can include more than one county. The 2011 AHS survey identifies eight MSAs in California: Anaheim, Los Angeles, Oakland, Riverside, Sacramento, San Diego, San Francisco, and San Jose. (See Figure 2 for a map of these MSAs.) Table 7 shows the MSAs used for this analysis and the corresponding counties.

Table 7. California MSAs in the 2011 AHS Data and Corresponding Counties

MSA Name	MSA ID	Counties
Anaheim	0360	Orange
Los Angeles	4480	Los Angeles
Oakland	5775	Alameda, Contra Costa
Sacramento	6920	El Dorado, Placer, Sacramento, Yolo
Riverside	6780	Riverside, San Bernardino
San Diego	7320	San Diego
San Francisco	7360	Marin, San Francisco, San Mateo,
San Jose	7400	San Benito, Santa Clara

The 2011 AHS survey encompasses 26,601 interviews (completed between July and December of 2011) in occupied households in non-institutional settings in California.[4] Because the data—which are grouped by MSA—do not include all customers in the state or of the IOUs, we do not contend that these data reflect either the absolute numbers of all multifamily or the subset of low-income multifamily households. Rather, we consider the relative percentages of low-income multifamily units to be important indicators of the sector as a whole and especially of relatively urban areas.

The MSAs included in the 2011 AHS survey encompass all of the largest metropolitan areas of California and thus include a large proportion of utility customers. Table 8 shows the estimated number and percentage of utility households and low-income households included within the eight AHS MSAs.[5]

Table 8. Estimated IOU Population Included Within AHS MSAs

Utility/Fuel	MSA Households	Total Households	MSA Low-income Households	Total Low-income Households
PG&E Electric	4,263,939	53%	1,175,083	42%
PG&E Gas	4,756,266	61%	1,299,746	51%
PG&E Combined	5,185,236	56%	1,458,581	46%
SCE Electric	4,115,093	87%	1,239,688	87%
SDG&E Electric	1,169,705	100%	302,148	100%
SDG&E Gas	1,064,048	100%	286,965	100%
SDG&E Combined	1,169,705	100%	301,947	100%
SCG Gas	6,167,353	86%	1,980,239	86%

4 Institutional settings include, for instance, dormitories, barracks, and prisons.

5 The percentage of total households was estimated using county-level data provided by John Peterson at Athens Research. MSAs are contiguous with county boundaries. Athens provided the number of utility customers in each county and we calculated the proportion of total customers in counties within the MSA boundaries.

Methodology

The criteria for Cadmus' targeted class of respondents are as follows: (1) households living within multifamily buildings, (2) in which there are five or more units, and (3) the households have an income that is at or below 200% of the federally defined poverty level (LIMF households).

For comparison purposes, we have presented many of the findings for the following five other classes of households:

- Low-income households in multifamily buildings having from two to four units;
- Low-income households in single-family buildings, including mobile homes;
- Households with adequate income—that is, households with an income above 200% of the federal poverty guidelines—in multifamily buildings having five or more units;
- Households that have adequate income and that reside in multifamily buildings containing from two to four units; and
- Households with adequate income in single-family buildings, including mobile homes.

In most instances, we report both the percentage of distributions of important AHS survey items for the different household types *and* the distributions for low-income multifamily households across the eight MSAs. In general, the sample size is large enough so that even small differences between one household type and another (or between MSAs) are statistically significant. In this report, we call out the most interesting contrasts we observe.

Sample Size

Table 9 shows the number of interviews completed—organized by household type—for the eight MSAs in the AHS California sample (Table 7). Note that these are raw, unweighted counts of responses.

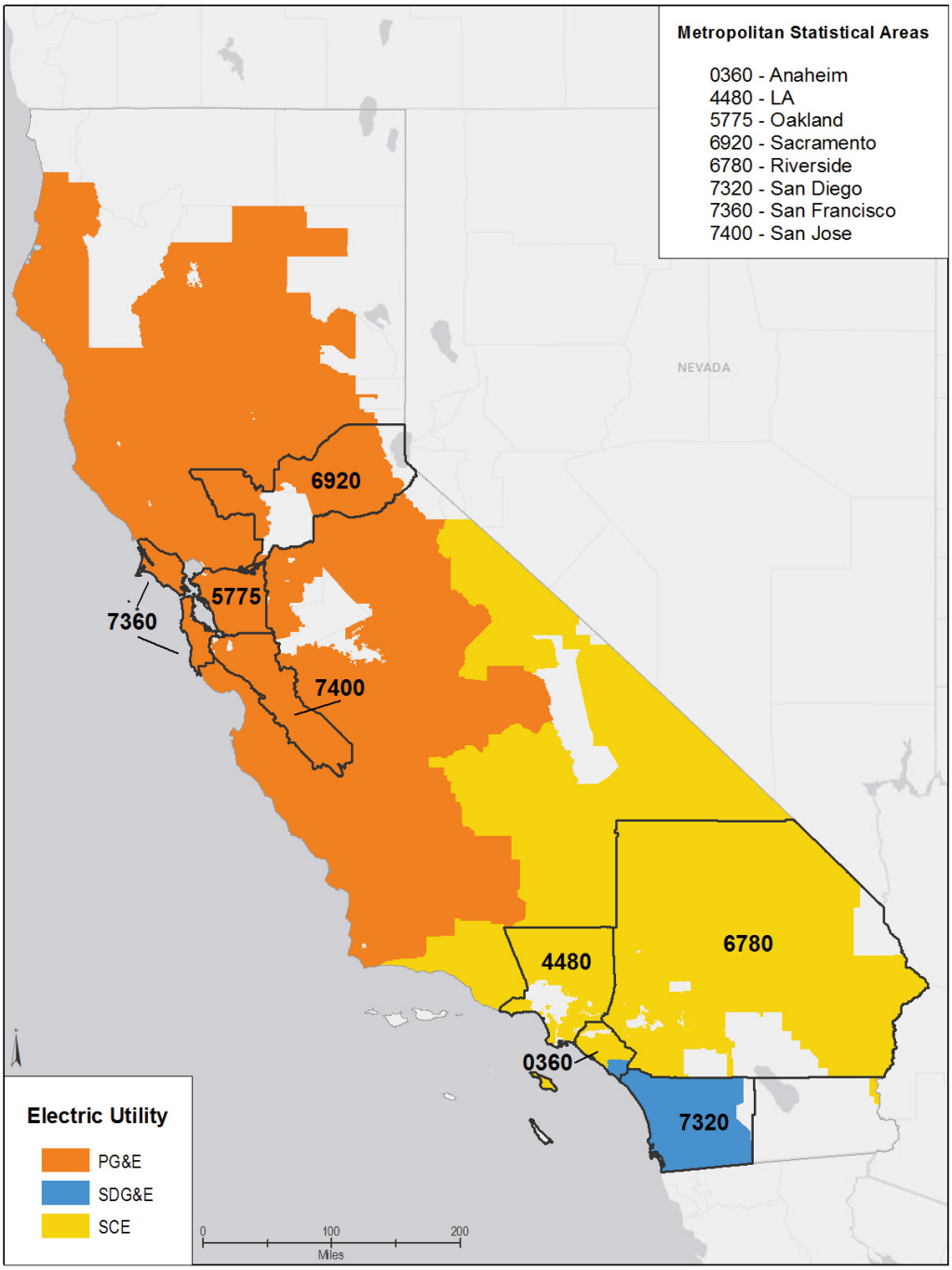
The response rate for the 2011 AHS survey exceeded 85% of contacted households for all California MSAs. Interviews were completed with 2,888 low-income households in multifamily buildings. This shows the robustness of the survey effort relative to other sources of information about LIMF households

.

Table 9. HUD American Housing Survey Sample Size by Household Type and MSA

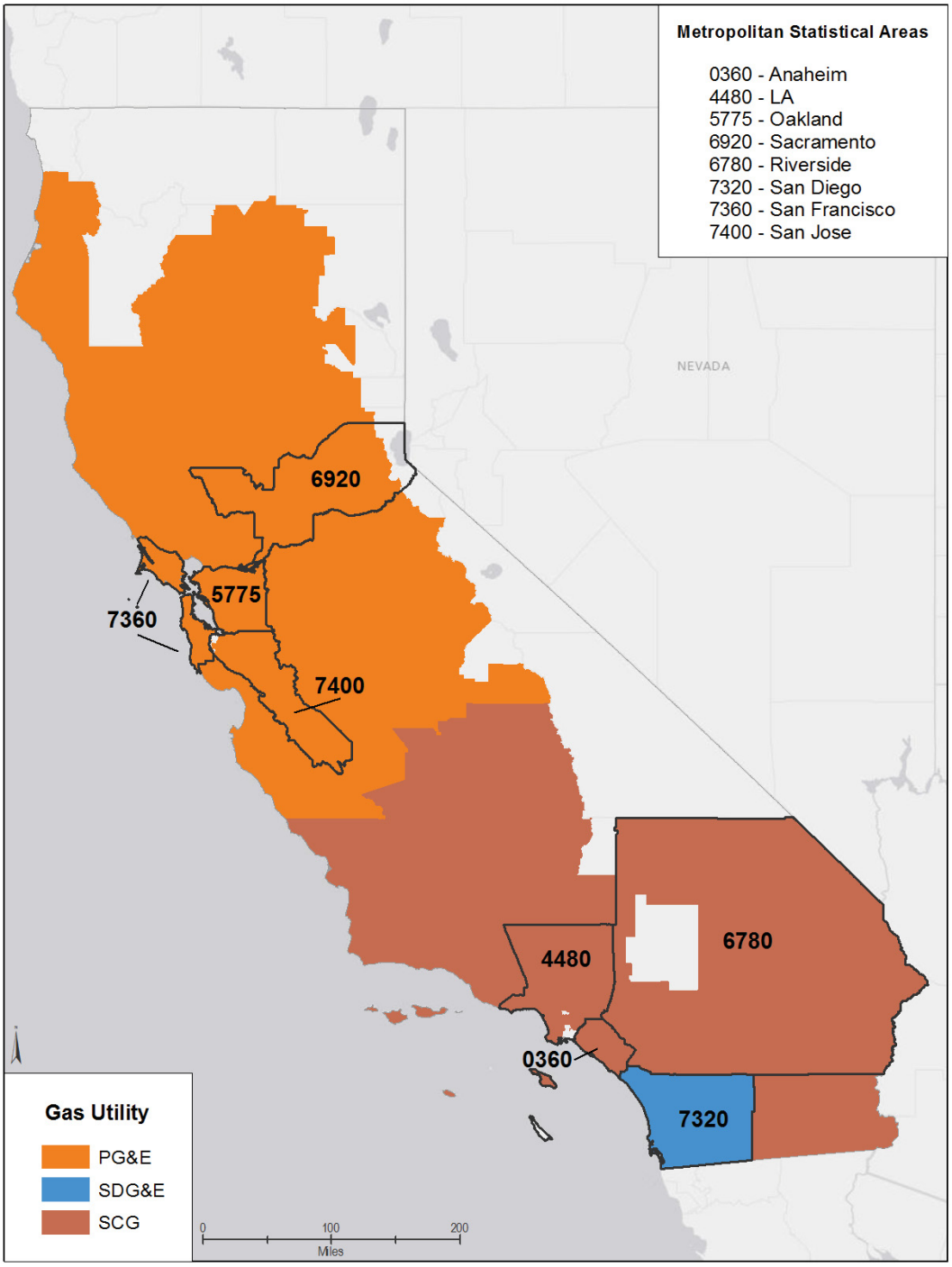
Sector	MSA								
	Anaheim	Los Angeles	Oakland	Riverside	Sacramento	San Diego	San Francisco	San Jose	Total
Low-income Multifamily 5+	336	640	301	204	301	412	393	301	**2,888**
Low-income Multifamily 2-4	184	194	143	162	120	118	108	110	**1,139**
Low-income Single Family	486	707	453	919	613	537	269	475	**4,459**
Adequate Income Multifamily 5+	478	532	359	134	205	479	705	566	**3,458**
Adequate Income Multifamily 2-4	204	140	197	61	88	169	405	161	**1,425**
Adequate Income Single Family	1,792	1,201	1,826	1,559	1,805	1,690	1,410	1,947	**13,230**
Total	**3,480**	**3,414**	**3,279**	**3,039**	**3,132**	**3,405**	**3,290**	**3,560**	**26,599**

Figure 2. California MSAs and Electric Utility Service Territories[6]



6 Electric and Natural Gas GIS data layers provided by the California Energy Commission. Electric Service Areas updated as of 10/30/2012. Gas Service Areas updated as of 10/29/2012.

Figure 3. California MSAs and Gas Utility Service Territories[7]



[7] Electric and Natural Gas GIS data layers provided by the California Energy Commission. Electric Service Areas updated as of 10/30/2012. Gas Service Areas updated as of 10/29/2012.

Household Types by MSA

Cadmus applied census weights to the HUD AHS survey data to estimate both the number of households in each of California's eight MSA s and the percentage of households of each household type (Table 10).

- The percentages sum to 100% down the columns, showing, for instance, that 9.1% of households in Anaheim are low-income multifamily in buildings having five or more units.
- The percentages in the Total row sum to 100%, showing, for instance, that 10.5% of households in the MSA represented by the survey are in Anaheim.

Comparing the percentages to the *Total* column shows whether an MSA has relatively more or fewer of that type of household than do other MSAs. For instance, in multifamily buildings having five or more units, there are relatively more low-income multifamily households (16.3%) in Los Angeles' MSA than in the MSAs overall (12.1% of households). Moreover, Los Angeles comprises more than one-third of all households in the MSAs covered by the survey and, in fact, contains nearly half of the target households among that set of major MSAs.

Table 10. Estimated Frequency and Percentage of Household Types by Selected MSA*

Sector	Statistic	MSA								
		Anaheim	Los Angeles	Oakland	Riverside	Sacramento	San Diego	San Francisco	San Jose	Total
Low-income Multifamily with 5+ units	Frequency	82,857	506,686	77,770	61,135	64,952	128,620	75,082	49,202	**1,046,303**
	Percentage	9.1%	16.3%	9.3%	6.6%	10.0%	12.9%	11.7%	8.5%	**12.1%**
Low-income Multifamily 2-4	Frequency	49,165	168,994	40,741	45,028	26,491	33,721	19,980	25,468	**409,589**
	Percentage	5.4%	5.4%	4.9%	4.8%	4.1%	3.4%	3.1%	4.4%	**4.7%**
Low-income Single-Family	Frequency	125,842	654,421	114,313	255,608	126,153	157,238	41,412	70,009	**1,544,997**
	Percentage	13.8%	21.1%	13.6%	27.4%	19.4%	15.7%	6.5%	12.1%	**17.9%**
Total Low-income	Frequency	257,864	1,330,101	232,824	361,771	217,596	319,579	136,474	144,679	**3,000,889**
	Percentage	28.3%	42.8%	27.8%	38.8%	33.5%	32.0%	21.3%	25.0%	**34.7%**
Adequate Income Multifamily 5+	Frequency	126,603	502,220	102,696	42,823	49,873	147,571	138,341	87,350	**1,197,477**
	Percentage	13.9%	16.2%	12.2%	4.6%	7.7%	14.8%	21.6%	15.1%	**13.8%**
Adequate Income Multifamily 2-4	Frequency	46,858	130,721	48,805	20,119	15,408	44,352	86,020	23,109	**415,393**
	Percentage	5.1%	4.2%	5.8%	2.2%	2.4%	4.4%	13.4%	4.0%	**4.8%**
Adequate Income Single-Family	Frequency	480,995	1,141,777	455,357	508,087	367,056	487,573	280,266	322,328	**4,043,439**
	Percentage	52.7%	36.8%	54.2%	54.5%	56.5%	48.8%	43.7%	55.8%	**46.7%**
Total Adequate Income	Frequency	654,456	1,774,718	606,858	571,029	432,337	679,496	504,627	432,787	**5,656,309**
	Percentage	71.7%	57.2%	72.2%	61.3%	66.6%	68.0%	78.7%	74.9%	**65.3%**
Total	**Frequency**	**912,320**	**3,104,820**	**839,682**	**932,800**	**649,934**	**999,075**	**641,102**	**577,465**	**8,657,197**
	Percentage	**10.5%**	**35.9%**	**9.7%**	**10.8%**	**7.5%**	**11.5%**	**7.4%**	**6.7%**	**100.0%**

* Percentages sum to 100% down the columns except for the Totals, which sum across to show percentages of households from each MSA living within the surveyed MSAs.

Table 11 shows low-income multifamily households as a proportion of low-income households, multifamily households, and total households, by MSA.

Table 11. Low-income Multifamily as a Percentage of Households, by MSA

Sector	MSA								
	Anaheim	Los Angeles	Oakland	Riverside	Sacramento	San Diego	San Francisco	San Jose	Total
Low-income Multifamily with 5+ units	82,857	506,686	77,770	61,135	64,952	128,620	75,082	49,202	**1,046,303**
Percentage of Low-income Households	32%	38%	33%	17%	30%	40%	55%	34%	**35%**
Percentage of Multifamily Households	40%	50%	43%	59%	57%	47%	35%	36%	**47%**
Percentage of Total Households	9%	16%	9%	7%	10%	13%	12%	9%	**12%**

Appendix E. ESA Program and MFEER Penetration in the Low-Income Multifamily Sector

To understand the penetration of the ESA Program into the low-income multifamily sector, Cadmus conducted a regression analysis of census tract data. If program delivery is uniform across the state, we would expect a simple—and, ideally—linear relationship between the number of eligible multifamily households and the number of participating multifamily households. Significant parameter values on additional predictor variables related to socio-demographics would indicate that these factors either increase or decrease the rate of program penetration.

Regression Model of ESA Program Penetration

Given that the ESA Program serves LIMF household units, we might theorize a statistically significant positive correlation between LIMF and ESA Program participants: that is, in census tracts where there are more LIMF units, there should also be more ESA Program participants, all else being the same.

In a related vein, a tract's median household income should be negatively correlated with ESA Program participation, if correlated at all. Thus, the wealthier a neighborhood is, in general, the lower the ESA Program participation. However, we expect this correlation to be weak because: (1) wealth can be—and often is—concentrated in a small number of households; and (2) the census tracts are large enough that they may contain significant numbers of both high- and low-income households.

In advance of the analysis, we expect no bias towards the racial and ethnic makeup of a census tract: ESA Program participation should be determined without regard to the residents' race or ethnicity. We do know that race and ethnicity are correlated with income. The value of the regression model is that it will control for wealth as it considers the effect of race and ethnicity.

As we noted regarding race and ethnicity, we do not theorize a statistically significant correlation between the proportion of population that speaks English as the primary language and the number of ESA Program participants. Again, the ESA Program should only target the income-eligible housing units, regardless of the residents' other characteristics. If a significant relationship is found, we expect it to be a positive one: the larger the number of English speakers, the greater the ESA Program participation. This would reflect the presence of a language barrier in the implementation of the program.

We do not expect to find a relationship between the number of multifamily households within a census tract and the number of ESA Program participants. To cover the population equally, the program would have to serve LIMF households that are thinly dispersed in the population at the same rate as households that are concentrated. This may be difficult to achieve, however. If we find a relationship, we would predict that high-density areas would have a higher participation rate than low-density areas.

Data

There are 8,057 census tracts in the state of California. Of these, 79 do not contain households, so we excluded them from our dataset. See below for a full list of the variables tested.

In our regression analysis, the dependent variable is the number of units participating in the ESA Program per California census tract. Our explanatory variable of interest is the estimated number of LIMF units per tract. We control for a number of other variables per tract, including socio-economic demographics (such as median income and racial diversity) and the built environment specifications of the tracts (such as the total number of multifamily units). We also control for the IOU that serves the majority of the census tract, so we can determine whether some utilities have higher ESA Program penetration than others.

To control for IOU territories, we created categorical (dummy) variables for each IOU by overlaying the service territories for PG&E, SCE, SCG and SDG&E on top of the census tracts. For each IOU by fuel type, we assigned households to utilities in proportion to the percentage of each census tract that falls within each IOU's territory. We found that of the 7,978 tracts with one or more households, 86 are completely outside of the four IOUs' service territories, leaving 7,892 census tracts in our model. Of these, SCG covers the largest number of tracts at 4,129 and SDG&E covers the smallest at 678.

It is important to note that these IOU dummy variables are not necessarily mutually exclusive. Some gas territories overlap electricity territories within and across the four IOUs. In fact, there are a total of 2,785 tracts where this happens. SCG and SCE have an especially large number of overlapping census tract territories (2,484), considering that the two IOU subsidiaries both cover Southern California.

Because we do not have exact data on the number of LIMF units in each census tract, we undertook a rigorous estimation process. Cadmus fit the census tract data to both log-normal and negative binomial distributions. These are appropriate distributions for data representing counts of entities, such as households, where:

- We expect a high proportion of observations (e.g., census tracts) to have small numbers or zero values, and
- There can be no negative values.

For each distribution, we ran several models to predict the number of ESA Program participants in each census tract, based on a number of control variables. A full discussion of these modeling efforts is presented below.

Findings

Cadmus developed a base regression model using only the predictor variables that our *a priori* assumptions led us to believe should be related to ESA Program participation; that is, (1) the number of low-income multifamily households, and (2) the median income of the census tract. We then fit an expanded model using the additional variables representing possible influencing factors.

Base Model

Table 12 shows the parameter values and fit statistics for an Ordinary Least Squares (OLS) regression on our log-transformed dependent variable, the number of ESA Program participants. Our base model has only two predictor variables:

- The natural log of the number of low-income multifamily households within the census tract, and
- The natural log of the median income (in thousands of dollars) of the census tract.

We estimated the model separately for each IOU service territory and for the combined territories, which encompasses all census tracts with greater-than-zero households served by one of the IOUs. All models and parameter values are significant, and that the percentage of explained variance (R-Squared) is reasonably good, although the SCG model and the overall model are weaker.

Table 12. Parameter Values and Fit Statistics for Base Regression Model

Parameter	PG&E		SCE		SCG		SDG&E		Combined Territories	
	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value
Intercept	6.45423	<.0001	10.02656	<.0001	5.35443	<.0001	13.85773	<.0001	6.09658	<.0001
Log of LIMF	0.50829	<.0001	0.53618	<.0001	0.3429	<.0001	0.41887	<.0001	0.423	<.0001
Log of Median Income	-2.0401	<.0001	-2.70028	<.0001	-1.77568	<.0001	-3.87493	<.0001	-1.95949	<.0001
Obs. Used:	3184		2678		4126		677		7883	
DF	2		2		2		2		2	
F Value	911.05		1430.26		498.94		337.3		1489.63	
Pr > F	<.0001		<.0001		<.0001		<.0001		<.0001	
R-Squared	0.3642		0.5168		0.1949		0.5002		0.2744	

Once variables are log transformed, their coefficient interpretation becomes less intuitive. If both the dependent variable (y) and independent variable (x) of a model have been log-transformed, the parameter value for x becomes the elasticity of y with respect to x, describing the rate of change in y in terms of changes in x. Thus, comparing two census tracts, the relationship predicted by our base model between ESA Program and LIMF for PG&E is as shown below.

$$ESAP_2/ESAP_1 = (LIMF_2/LIMF_1)^{0.5082}$$

Where:

- $ESAP_2/ESAP_1$ = The ratio of difference in the number of ESA Program households between two census tracts
- $LIMF_2/LIMF_1$ = The ratio of difference in the number of LIMF households between two census tracts
- 0.5082 = The estimated value of the coefficient describing the relationship between the two ratios

A difference in the number of LIMF PG&E households, for example, from 100 to 200 households, would be associated with a predicted difference in ESA Program participation of $(200/100)^{0.5082} = 2^{0.5082} = 1.42$. A doubling of LIMF households leads to a 42% increase in ESA Program participation. Thus, the direction of the relationship is as expected, with ESA Program having a higher rate of program penetration where there are more LIMF households. However; the increase in ESA Program participation does not keep up with increases in LIMF, and high concentrations of LIMF tend to be served at a lower rate of penetration than lower concentrations. In other words, ESA Program participation goes up with a rise in the number of LIMF households, but the percentage of LIMF households served tends to go down.

For income, the negative sign of the coefficient indicates that, as predicted, ESA Program participation goes down as the median income of a census tract goes up. The rate of change among PG&E census tracts is $(200/100)^{-2.0401} = 2^{-2.0401} = 0.24$. This means a doubling of income would yield about a quartering of ESA Program participants. Again, this relationship is in the expected direction and shows the keen sensitivity of ESA Program penetration to income.

Table 13 shows the rate of change of ESA Program participation relative to each predictor variable, assuming the value of the predictor variable doubles. It is important to understand the nature of this change: it is not a change in time but rather a change from one area to another, holding other differences constant. All coefficients are in the expected direction but the relative rates of change are different among the utilities. For LIMF, PG&E and SCE have similar relative rates, but SCG and SDG&E rates are lower. This means a change in the number of ESA Program participants lags further behind a change in the number of low-income multifamily households. For SDG&E, a doubling of eligible households yields a 34% increase in participants; for SCG, a doubling of eligible households yields a 27% increase in participants.

Table 13. Relative Effect of Predictor Variables on ESA Program Participation by Utility

	Change in ESA Program				
	PG&E	SCE	SCG	SDG&E	All Census Tracts
From Doubling of LIMF	1.42	1.45	1.27	1.34	1.34
From Doubling of Median Income ($1,000)	0.24	0.15	0.29	0.07	0.26

Table 13 also shows differences in the effect of income on ESA Program participation. In general, the smaller the number, the stronger the effect of changes in income on reduced ESA Program participation. That is, a doubling of the median income is associated with a reduction in ESA Program participation by about 5/6 in SCE's territory, and a much larger reduction of 13/14 in SDG&E's territory.

Thus, from the base model we conclude that ESA Program is generally performing as expected with respect to income, tending to serve areas with lower-income households more than areas with higher-income households. The rate of penetration does not keep pace with the number of LIMF households, however, suggesting there is more work to be done in the areas with highest concentrations.

Expanded Model

As discussed in the introduction to this section, Cadmus' intent is to examine whether the penetration of the ESA Program is affected by factors that can be identified within the census data. These factors primarily relate to racial and ethnic identification and limited English proficiency (LEP). We also looked at the number of multifamily households as a predictor.

Table 14 shows the parameter values and fit statistics for an expanded OLS regression on our log-transformed dependent variable. This includes predictor variables for the percentage of the population that identifies as black, as Hispanic (these are not mutually exclusive categories), and as other ethnic groups, and for the percentage of the population for whom English is not their first language. We also included a predictor for the number of multifamily households of all income levels. In this table, parameter values in red text are insignificantly related to the dependent variable.

In other models, we tried a variety of other predictors, such as variables for other ethnic groups and for the level of education. These variables were not significantly related to the dependent variable, and we dropped them. Again, we estimated the model separately for each IOU service territory and for the combined territories.

In general, the predictive power of the expanded models, as indicated by the R-squared values, increases compared to the base models. All models are significant overall—meaning the relationship among variables is not random—but some of the new predictor variables in some models are not significantly related to the dependent variable. The coefficients of the parameters used in the base regression model are all still significant, but they have different values. Controlling for race, ethnicity, language, and multifamily households reduces the relative rates of change for both predictors.

Table 14. Parameter Values and Fit Statistics for Expanded Regression Model

	PG&E Territory		SCE Territory		SCG Territory		SDG&E Territory		All Census Tracts	
	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value
Intercept	4.3553	<.0001	5.0449	<0.0001	0.1707	0.7743	10.3679	<.0001	2.7599	<0.0001
Log of LIMF	0.4138	<.0001	0.4530	<0.0001	0.3413	<0.0001	0.3143	<.0001	0.3839	<0.0001
Log of Median Income	-1.6800	<.0001	-1.7797	<0.0001	-0.7875	<0.0001	-3.1988	<.0001	-1.3383	<0.0001
Total Multifamily Households	0.0012	<.0001	0.0007	<0.0001	-0.0001	0.0611	0.0010	<.0001	0.0003	0.0038
Total Black Population	<0.0001	0.9389	0.0004	<0.0001	0.0001	0.1805	0.0001	0.8664	0.0002	0.0383
Total Hispanic Population	<0.0001	0.8508	<0.0001	0.8932	<0.0001	0.0344	0.0005	0.0007	0.0001	0.0052
Total Other Population	0.0007	0.0001	0.0003	0.0005	0.0001	<0.0001	-0.0014	<.0001	0.0003	0.0036
Total English Barrier Population	0.0003	0.0021	0.0008	<0.0001	0.0001	<0.0001	0.0004	0.0816	0.0004	<0.0001
Obs. Used:	3184		2678		4126		677		7883	
DF	7		7		7		7		7	
F Value	296.88		530.50		199.48		114.30		488.53	
Pr > F	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
R-Squared	0.3955		0.5817		0.2532		0.5446		0.3022	

The new variables in our model are not log-transformed values. For these, the interpretation of coefficients is different than for the transformed variables. The parameter value is interpreted as the percentage of increase in the dependent variable from a one-unit increase in the independent variable. Thus, the parameter value 0.0012 for total multifamily households in the PG&E model means that for every additional household there is 0.12% increase—*twelve-hundredths of a percent*—in ESA Program participation.

That is, for every additional 100 multifamily households in a census tract, we expect a 12% increase in ESA Program participation. Since the average number of ESA Program participants per census tract is about 20, the impact to an otherwise average census tract of an additional 100 multifamily households would be an additional 2.4 participants.

The non-transformed predictor variables can be directly compared to one another to assess their relative strength. It is important to underscore that all of these—except for multifamily households—are defined by numbers of individual people, not by households. For example, in the PG&E model, the relative effect on ESA Program participation of size of the "other" ethic group (0.0007) is approximately half that of multifamily households (0.0012) and a little more than twice the effect of the number of the English barrier population (0.0003).

Table 15 shows the relative effect of the different predictor variables on ESA Program participation. Note that the log-transformed parameters have a different interpretation than the non-transformed parameters—percentage change associated with percentage change rather than unit change associated with percentage change—and, thus, the parameters should not be directly compared in terms of relative effect.

Table 15. Relative Effect of Predictor Variables on ESA Program Participation

	Change in ESA Program				
	PG&E	SCE	SCG	SDG&E	All Census Tracts
From doubling of LIMF	1.33	1.37	1.27	1.24	1.30
From doubling of median income ($1000)	0.31	0.29	0.58	0.11	0.40
From 100 additional multifamily households	0.12	0.07	-0.01	0.10	0.03
From 100 additional black population		0.04			0.02
From 100 additional Hispanic population				0.05	0.01
From 100 additional other population	0.07	0.03	0.01	-0.14	0.03
From 100 additional LEP population	0.03	0.08	0.01	0.04	0.04

Discussion

In this section, Cadmus discusses the implication of each of the parameter values of the model.

Number of Low-Income Multifamily Households

We have already considered the significance of parameter values for the (logged) number of low-income multifamily households. To restate the relationship, as expected, we have evidence that where there are more eligible households, there are more ESA Program participants. The increase in participation, however, is not in the same proportion as the increase in eligible households; rather, participation rises not in step with increases in eligibility but at a lower rate. For instance, in the all-census tracts model, comparing two tracts that are the same except one has twice the number of low-income multifamily households, our model indicates not double but only 30% more ESA Program participants in that tract.

This finding could be a result of the time horizon of our data, since we are considering only three years of ESA Program participation data. (We will discuss this further later in this section.) Another possibility is that an effort on the part of programs to achieve geographic dispersion across a utility's territory has resulted in over-dispersion relative to the concentration of low-income multifamily households.

Median Income

We have little to add to our previous discussion of the effect of income on ESA Program participation. The coefficients all have the correct sign, and the size of the effect does not raise particular issues that we can identify. The fact that some utilities have a stronger decrease in ESA Program participation related to median income could well reflect nothing more than the relative segregation of low-income households within the different territories. If low-income households tend to be more thoroughly mixed in among higher-income households, we would expect a weaker relationship with ESA Program participation. Thus, an increase in median income has a strong suppressive effect on ESA Program participation. This supports a finding of our mapping of penetration, that where LIMF households exist among more-affluent households, they are less likely to be served by the program.

Number of Multifamily Households

We included a predictor variable representing the number of multifamily households to test the assumption that program implementers may use concentrations of multifamily housing as way of efficiently targeting participants. (This would result in households that are in areas with lower density of multifamily housing being less-well served.) For three of the four utilities, we do find an indication that concentration of multifamily housing in a particular area is associated with increased ESA Program participation. It is important to note that the model has already controlled for the number of low-income multifamily households, so this is a separate effect of only the concentration of multifamily units. The exception is SCG, where the relationship runs in the other direction, although the size of the effect is smaller.

Racial and Ethnic Identity

Significant parameter values for the three items relating to race and ethnicity suggest some targeting of ESA Program by these categories—or at least targeting that has the effect of increasing participation by these categories. We might call it over-representation, with the caveat that this is intended only in a statistical sense. We note that the size of the effect tends to be small: an increase in ESA Program participation ranging from 1% to 7% per 100 additional householders who identify with each category. The over-represented identity is also different for the different utilities: blacks for SCE; Hispanics for SCG and SDG&E; and *other* for PG&E, SCE, and SCG. Interestingly, the identity *other* ethnicity is associated with lower ESA Program participation in SDG&E's territory.

Language

We had two contradictory conjectures about LEP households and ESA Program participation.

- Either reduced facility with English could be a barrier to participation, insofar as households would be less aware of the program and less likely to seek out participation, or
- Reduced facility with English could be associated with increased participation, much as race and ethnicity are, if programs make a special effort to engage communities with language barriers.

Because all utilities have positive coefficient values for English barrier, our research suggests the latter scenario. Communities with more people who lack facility with English have a higher rate of participation. Since the model controlled for population, this is a separate language effect.

Additional Details About the Regression Modeling

Variables Tested in the Model

We collected and manipulated many variables at the census tract level that cover a number of neighborhood characteristics (see Table 16). We chose a combination of these parameters to include in our expanded model after determining their meaning, effects on the model, and statistical significance.

Table 16. Parameters Included in Dataset and Descriptions

Variable Name	Description
tot_pop	Total census tract population
total_households	Total number of household units
tot_mf	Total number of multifamily units
tot_limf	(Estimated) Low-income multifamily units
esa_participants	Number of ESA Program participants
pct_mf	Percentage of household units that belong to multifamily buildings
pct_limf	Percentage of household units that are low-income multifamily
pct_esa	Percentage of eligible LIMF households that participated in ESA Program
pct_ed_9gr	Percentage of households with less than 9th grade education
pct_ed_no_dipl	Percentage of population without a high school diploma
pct_ed_hsg	Percentage of population that are high school graduates
pct_ed_somecoll	Percentage of population with some college education

Variable Name	Description
pct_eng	Percentage of population that speaks English "very well"
pct_noeng	Percentage of population that speaks English less than “very well”
tot_eng	Total population that speaks English "very well"
tot_noeng	Total population that speaks English less than “very well”
medinc1000	Median Household Income, in thousands of dollars
pct_white	Percentage of population that is white
pct_bl	Percentage of population that is black or African American
pct_ai	Percentage of population that is American Indian
pct_asian	Percentage of population that is Asian
pct_pi	Percentage of population that is Hawaiian or Pacific Islander
pct_other	Percentage of population that is an "other" race
pct_2races	Percentage of population that is two or more races
pct_hisp	Percentage of population that is Hispanic or Latino
tot_bl	Total population that is black or African American
tot_asian	Total population that is Asian
tot_ai	Total population that is American Indian
tot_hisp	Total population that is Hispanic or Latino
tot_pi	Total population that is Hawaiian or Pacific Islander
tot_other	Total population that is an "other" race
tot_2races	Total population that is two or more races
tot_white	Total population that is white
pge	Categorical variable for PGE territory: 1 is within PGE's territory, 0 not
sce	Categorical variable for SCE territory: 1 is within SCE's territory, 0 not
scg	Categorical variable for SCG territory: 1 is within SCG's territory, 0 not
sdge	Categorical variable for SDGE territory: 1 is within SDGE's territory, 0 not

When we created categorical (dummy) variables for the IOU territories, we found that SCG has the largest presence in California, followed by PG&E, SCE, and then SDG&E. Table 17 shows the number of census tracts in which an IOU’s service territory covers more than 50% of the area.

Table 17. Census Tracts by IOU

IOU	Number of Census Tracts
PG&E	3189
SCE	2681
SCG	4129
SDG&E	678

Many census tracts were counted in more than one IOU territory, and Table 18

Table 18 lists the number of census tracts that are counted by both IOUs.

Table 18. Non-Mutuality of IOU Territory Categorical Variables

	SCE	SCG	SDG&E
PG&E	0	246	0
SCE	--	2484	0
SCG	--	--	55

Summary Statistics of Data

Table 19 lists the central tendencies—divided by demographic category—of all the variables in the models' dataset. Note that some of these values are totals and some are percentages.

Table 19. Descriptive Statistics of Variables Included in the Dataset

			Median	Mean	Std. Deviation
Built Environment and Population Statistics					
Tot_Pop	12	36,880	4,415	4,588.46	1973.06
Total_Households	9	7,914	1,474	1,543.15	666.58
Tot_MF	0	7,132	209	350.16	450.65
Est_LIMF	0	2,045	86.86	148.27	178.16
ESA_Participants	0	567	2	19.57	45.80
pct_mf	0	0.98	0.13	0.21	0.23
pct_limf	0	0.73	0.06	0.09	0.11
pct_esa	0	-	0.03	0.16	0.47
Education and Economic Demographics					
Pct_Ed_9Gr	0	65	6.8	11.07	11.46
Pct_Ed_No_Dipl	0	50.4	7.9	9.12	6.62
Pct_Ed_HSG	0	53.5	21.6	21.21	7.97
Pct_Ed_SomeColl	0	56.8	21.6	21.64	7.22
pct_eng	0.18	1.00	0.844	0.8033	0.1528
pct_noeng	0	0.822	0.156	0.1967	0.1528
tot_eng	12	36,106	3,476.07	3,708.12	1,719.94
tot_noeng	0	8,322	684.7	928.65	830.58
medinc1000	4.08	227.5	60.36	66.47	30.95
Racial Demographics					
Pct_White	0	1.00	0.65	0.62	0.21
pct_bl	0	0.94	0.03	0.06	0.10
pct_ai	0	0.72	0.00	0.01	0.02
Pct_Asian	0	0.95	0.08	0.13	0.15
pct_pi	0	0.21	0.00	0.00	0.01
Pct_Other	0	0.77	0.09	0.14	0.14
pct_2races	0	1.00	0.03	0.04	0.03
pct_hisp	0	1.00	0.29	0.36	0.27

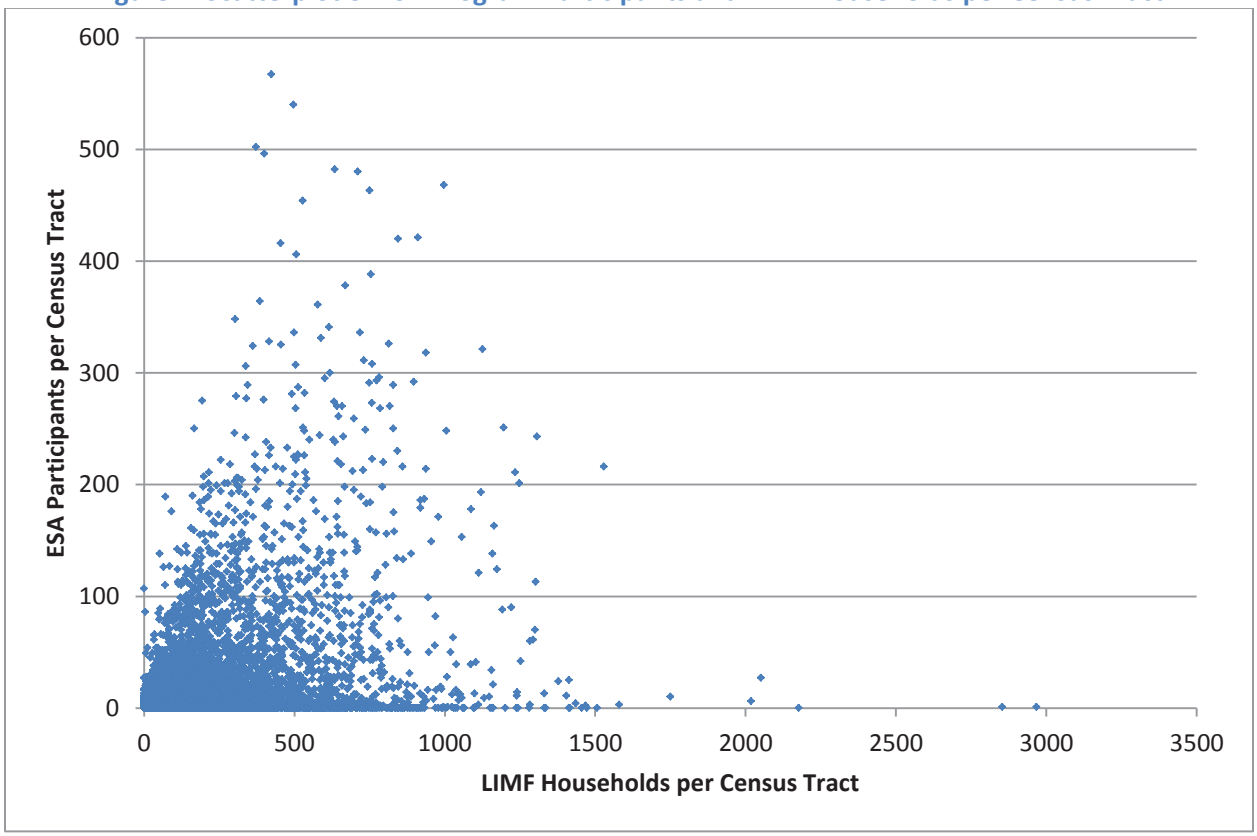
			Median	Mean	Std. Deviation
tot_bl	0	5,773	115.6	281.24	464.79
tot_asian	0	10,439	326.43	608.18	805.87
tot_ai	0	2,119	12.88	35.46	68.82
tot_hisp	0	13,488	1,273.65	1,732.49	1,537.79
tot_pi	0	1,268	0	17.76	54.63
tot_other	0	6,706	401.44	647.54	720.36
tot_2races	0	2,840	150.18	182.81	151.91
tot_white	0	23,050	2,653.66	2,863.81	1,509.52

Graphical Analysis

Figure 4 is a scatterplot showing ESA Program participants and LIMF units per census tract. The majority of tracts have less than 500 LIMF units and less than 100 ESA Program participants.

There appears to be a weakly positive linear correlation. Many tracts lie along the horizontal axis, representing high numbers of LIMF units with very low or zero ESA Program penetration. However, some points are very high outliers at greater than 10 standard deviations. Contrarily, some tracts appear to have near perfect ESA Program penetration, the maximum being 567.

Figure 4. Scatterplot of ESA Program Participants and LIMF Households per Census Tract



Analysis Methods

The original degree of skew in the ESA Program and LIMF may contribute to the violation of the assumption for a normal distribution required to run a normal ordinary least squares (OLS) statistical regression. Because of this, Cadmus tested two possible regression models that address this issue: negative binomial distribution and log-normal distribution.

- ***Negative Binomial Distribution.*** This is appropriate because it is designed to model "count" data that are over-dispersed, using maximum-likelihood estimation as opposed to ordinary least squares. This regression is typically used in analyzing crime data (in which the count number of crimes committed, for example, tends to be small relative to the total population). The negative binomial distribution is based on the Poisson distribution, which has a high left peak and a long right tail, much like our ESA Program data.
- ***Log-Normal Distribution.*** This entails log-transforming our ESA Program participants and LIMF variables and then running an OLS regression. It requires replacing the zero counts with a small positive number to avoid problematic missing data. We chose a value of 0.01 for this value. The log transformation better normalizes the variables, pulling the mean peak in towards the middle of the data.

Comparing the Regression Strategies

To compare the regression strategies, we plotted the respective residuals, which graphically show trends in the predictive error of the models. We found that the log-normal OLS regression was a better fit than the negative binomial, as it more accurately predicted the response variable (that is, with less error in the residuals).

The plot of predicted ESA Program participants to actual ESA Program participants in the negative binomial regression model (Figure 5) shows a number of very large negative outliers. This indicates that the model predicted very high ESA Program participants for a number of census tracts that, in fact, had very low values. The largest over-prediction in the negative-binomial regression is more than 38,000 ESA Program participants for a census tract in which the actual ESA Program participation is 1. More than 200 tracts have predictions that are three standard deviations above the mean ESA Program participation (greater than 156). The model attempts to force the data to the right-skewed distribution.

Figure 5. Negative Binomial Distribution Regression Model: Plot of Predicted to Actual ESA Program Participants.

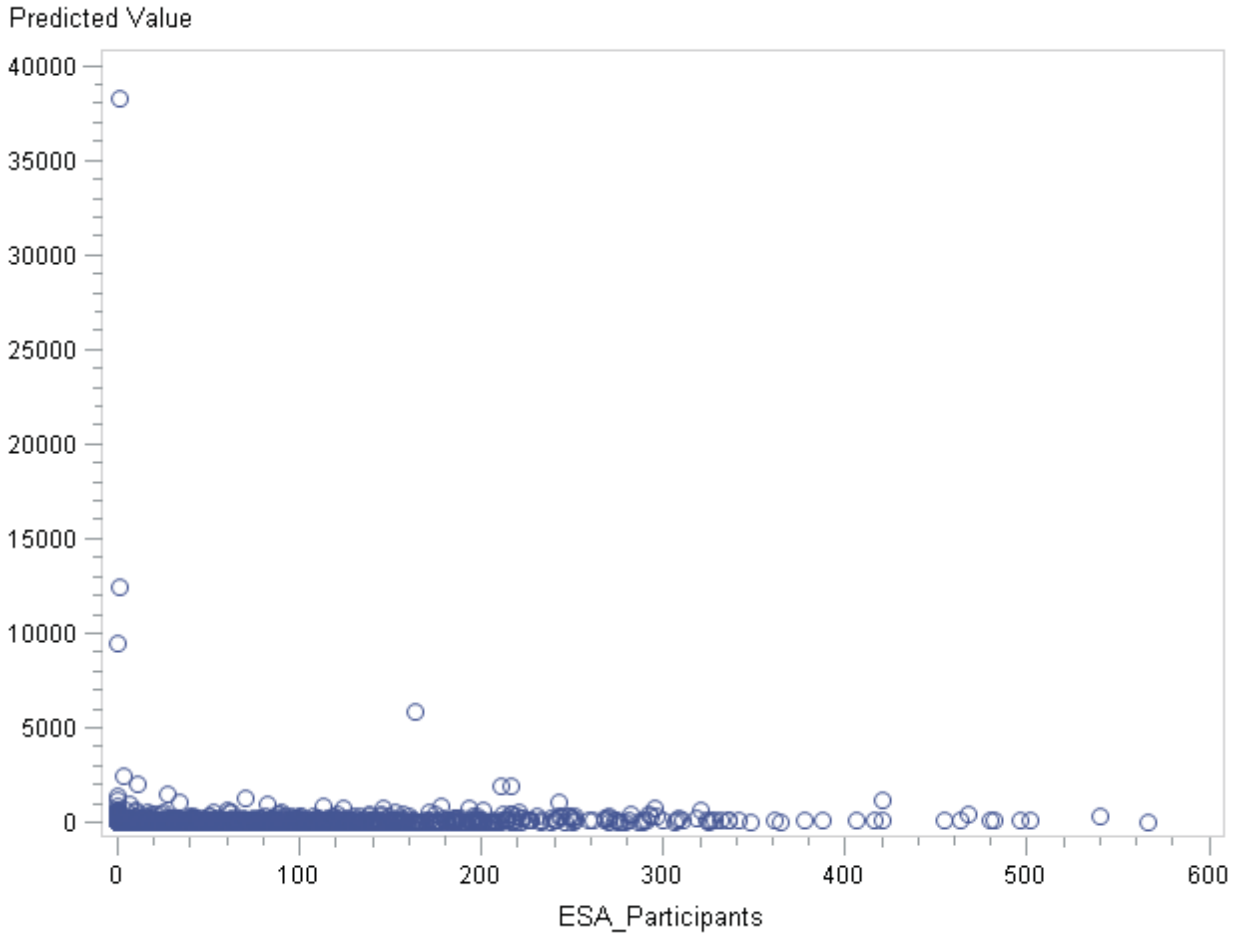
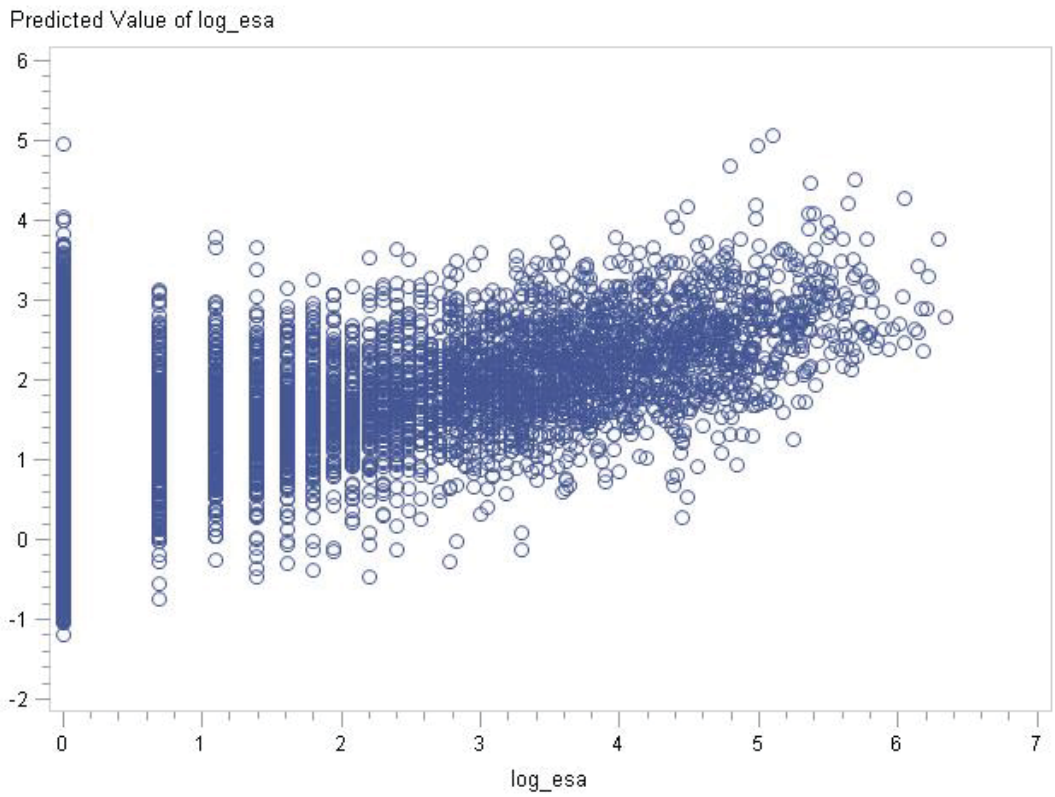


Figure 6 shows the predicted number of participants versus the actual ESA Program participants in the log-normal OLS regression model. A linear trend with a slope of 1:1 would indicate perfect prediction. Our findings show a slight trend toward under-prediction. Despite this, however, the OLS model has fewer outliers than the negative binomial regression model, thus reaffirming our choice to use this model.

Figure 6. Log-Normal OLS Regression Model:
Plot of Predicted to Actual ESA Program Participants.



Impact of MFEER Program on the Low-Income Multifamily Sector

The Multifamily Energy Efficiency Rebate (MFEER) program offers incentives to property owners and managers of multifamily buildings when they install energy-efficiency improvements in common areas and tenant units. Where low-income households live in units that benefit from the program, the MFEER program adds to the total set of services provided by utilities to low-income households.

Cadmus assessed the impact of MFEER on the low-income multifamily sector by analyzing three years of program participation data for each of the four IOUs in this study. We undertook two forms of analysis:

- Matches between addresses of MFEER and ESA Program participants, and
- Rate of participation by census tract of MFEER and the ESA Program.

It is important to note that MFEER serves properties, while the ESA Program serves tenants. Thus, a single property could have multiple ESA Program participants. Also, we are reviewing only three years of data for each program. What we seek to capture is the rate of crossover between the programs, not the total effect of MFEER on the low-income multifamily sector.

Method

Cadmus reviewed each utility's MFEER participant table for unique participant identifiers. However, because MFEER participants are defined as properties, not individual units, we needed to link the records for individual units to a single property. The SCE participation data contain batch numbers and project IDs that tie multiple units in the same building together; however, in cases where installation dates vary, multiple batch numbers and project IDs occur.

We consolidated the participant data from all utilities into a single data table and geocoded the records. Because unique street addresses are often associated with single units in multifamily properties—but no unique participant identifiers were provided with the data—we chose to geocode the participants and then use the latitude and longitude coordinates in an attempt to group properties that appeared to have more than one street address.

After some experimentation and review of the data, we determined that rounding the coordinates to three decimal places gave acceptable results. At 35 degrees north latitude, this represents a distance of about 91 meters. However, we observed that there are a number of properties that cover a relatively large geographic area (larger than one block). These properties include many distinct street addresses. In these instances, using the rounded coordinates did not succeed in producing unique identifiers for each property.

Geographically large properties were most prevalent in the SCE program data, where project/batch IDs were provided (although with some multiples due to differing installation dates). We found that by counting the distinct project/ batch IDs from the SCE tables and using the distinct rounded, concatenated latitude and longitude coordinates from the other tables, the results produced the least amount of double counting of properties. We note that this method still results in some degree of counting error; however, we have observed that MFEER participation does not have nearly as wide a distribution amongst census tracts as ESA Program participation (there are more individual ESA Program participants and fewer, more dispersed MFEER participants), so our method can at least be used to identify census tracts where there is some participation, versus none.

Properties Served by Both MFEER and ESA Program

We identified 9,939 distinct addresses that have participated in MFEER within the past three years for all utilities except SDG&E, for which we had only one year of data. Comparing those with the street addresses of ESA Program participants during the same period, we find 654 matched addresses. This suggests that MFEER has combined with ESA Program at about 6.6% of properties. Because of the difficulty in matching addresses for the two programs, we expect that this estimate probably under-represents the total number of combined program properties.

We also looked for latitude and longitude matches between the two programs. As noted, we considered two records matched when they were within 0.001 degrees latitude and longitude of one another. Using this approach we found 2,469 distinct MFEER locations, with 808 matching ESA Program locations, for a rate of 33% of MFEER locations serving ESA Program participants across all utilities.

Table 20 shows the number of MFEER-participating properties by utility (counting unique addresses or unique geographic coordinates) and the number and percentage of MFEER properties that also had ESA Program participants. For example, our data for PG&E MFEER participants contains 387 distinct addresses. Of these, 46 match addresses in the ESA Program participant database, so that 12% of MFEER addresses match an ESA Program address. Using geographic coordinates, we identify 372 MFEER participants, with 92 matching ESA Program coordinates, indicating a 25% match rate. SCE stands out as having a particularly high rate of overlap between MFEER and ESA Program participation, using geographic coordinates to identify matches.

Table 20. Number and Percentage of MFEER Properties Served by ESA Program

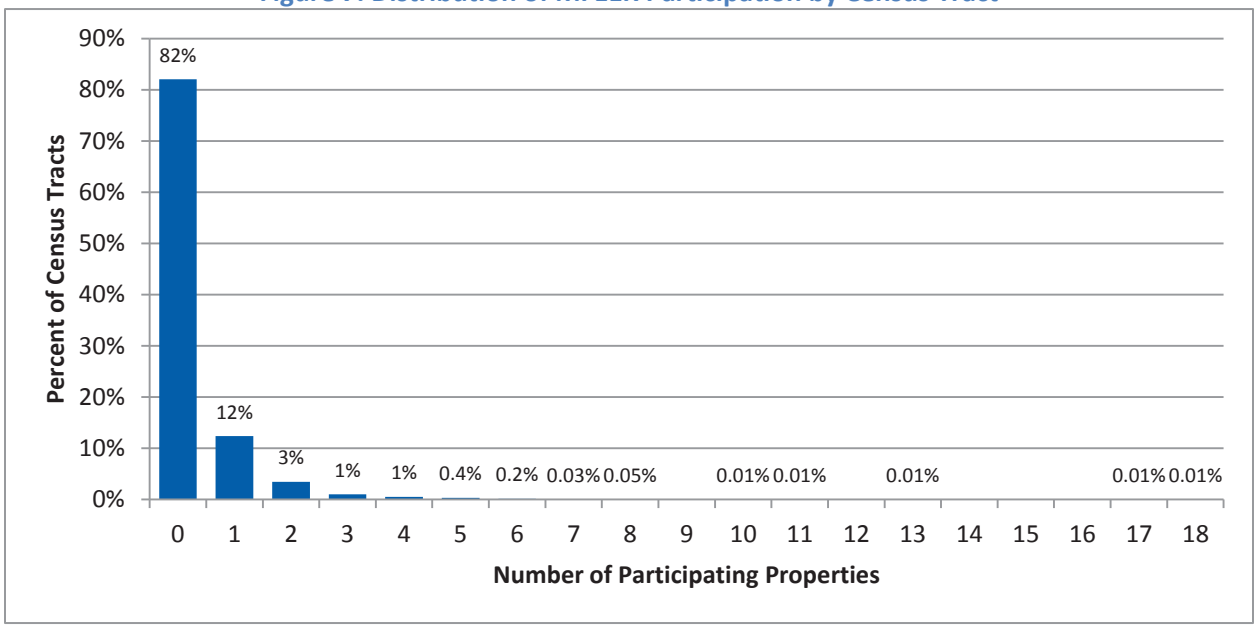
Utility	MFEER Addresses	MFEER & ESA Program Joint Addresses	ESA Program & MFEER Addresses	Unique MFEER Coordinates	Unique MFEER & ESA Program Coordinates	MFEER & ESA Program Coordinates
PG&E	387	46	12%	372	92	25%
SCE	7989	403	5%	946	424	45%
SCG	1120	149	13%	857	208	24%
SDG&E	445	56	13%	305	88	29%

MFEER Impact by Census Tract

Our program participation data suggest MFEER has not penetrated nearly as many areas as the ESA Program. Figure 7 shows the distribution of MFEER participation across all utility census tracts. Among 7,892 census tracts served by the four IOUs:

- 6,473 census tracts (82%) have had no properties participating in MFEER during the past three years, and
- 976 census tracts (12%) have had one participating property during this time.
- Only five census tracts have had 10 or more participating properties during this time.

Figure 7. Distribution of MFEER Participation by Census Tract



Given the small proportion of census tracts that have had any MFEER participation, Cadmus conducted a simple preliminary analysis of the data to assess whether tracts that have had MFEER participation are more likely to have had ESA Program participation. We compared the mean number of ESA Program participants among census tracts that have had some MFEER participation and those that had none. On average, census tracts with no MFEER participants—across all IOUs—had 15 ESA Program participants. However, census tracts that had at least one MFEER participant had more than double that number of ESA Program participants (an average of 39). This pattern persists across each of the IOUs, with a factor of two or three times as many ESA Program participants in census tracts with MFEER participants as in census tracts without MFEER participants. We conclude that MFEER and ESA Program tend to serve the same census tracts (the same geographical areas).

We wanted to rule out the *opportunity* explanation: that is, that more populous census tracts, or census tracts with more multifamily households, or with more low-income multifamily households, are more likely to have participants in both programs simply on the basis of more relevant units that have the opportunity participate.

We estimated a logistic regression model predicting the binary outcome of having MFEER participation within a census tract or not having MFEER participation, with explanatory variables for:

- The number of ESA Program participants,
- The total population of the census tract,
- The total number of multifamily households, and
- The number of low-income multifamily households.

If the relationship between MFEER and ESA Program participation is purely a matter of *opportunity* (that is, the number of available households), the coefficient for ESA Program participation in the model is expected to be non-significant, because all variance will be explained by the other variables in the model.

The model we estimated was:

$$logit(y) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$

Where:

- *logit(y)* is the log of the odds that a census tract has any MFEER participation
- α is the odds that a given census tract has any MFEER participation when all other variables in the model are set to zero
- β_n is the expected change in the log of the odds that a census tract has any MFEER participation from a unit change in variable x_n

Table 21 shows the results of our model. In summary:

- For PG&E and SDG&E, the opportunity explanation appears to account for the relationship between ESA Program and MFEER participation by census tract. The coefficients for ESA Program participation in these models are not significant.
- For SCE and SCG—even controlling for total population, the number of multifamily households, and the number of low-income multifamily households—the number of ESA Program participants is positively associated with the probability that at least one property has participated in MFEER.

Thus, the increased opportunity for participation does not appear to be a sufficient explanation for the relationship. We do not have direct evidence for what causes this association, but something in the way the two programs are administered may have created an increased likelihood that the two programs will operate in the same locations. The parameter value for ESA Program participants in both SCE and SCG territories suggests that for each additional ESA Program participant within a census tract, the likelihood that there will be at least one MFEER participant increase by slightly less than 1%.

Table 21. Parameter Values for Logistic Regression Model of MFEER Participation*

	PG&E Territory		SCE Territory		SCG Territory		SDG&E Territory		All Census Tracts	
	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value	Parameter Estimate	p-value
Intercept	-3.2804	<.0001	-2.1724	<.0001	-2.2800	<.0001	-1.8354	<.0001	-2.5285	<.0001
ESA Program Participants	0.0013	0.2646	0.0068	<.0001	0.0076	<.0001	0.0025	0.4215	0.0042	<.0001
Population (000)	0.0868	0.0064	0.0229	0.3841	0.0423	0.0508	-0.0374	0.3454	0.0419	0.0089
Multifamily Households	-0.0006	0.0630	0.0007	0.0398	0.0014	<.0001	0.0004	0.4132	0.0004	0.0236
Low-Income Multifamily	0.0043	<.0001	0.0024	0.0050	0.0005	0.3533	0.0034	0.0063	0.0026	<.0001
Obs. Used:	3189		2681		4129		678		7892	
DF	4		4		4		4		4	
Likelihood Ratio	133.03		410.45		575.87		113.46		853.48	
Pr > ChiSq	<.0001		<.0001		<.0001		<.0001		<.0001	

* Parameter values in red text are insignificantly related to the dependent variable.

Appendix F. Research Methodology and Sampling Plan for Building Owner and Manager Survey

Methodology

A survey with 124 building owners and managers of low-income multifamily buildings included operators of market-rate properties (73 respondents) and rent-assisted properties (51 respondents). The *sector* strata differentiated between market-rate housing and assisted-housing. Respondent groups were further stratified by the *size* of the properties they represented in California (0-25 units, 26-249 units, and 250 or more apartment units owned or managed in California). Survey weights were applied according to the stratum the respondents represented.

Sampling Plan

During the first public workshop held at the onset of this study (March 2013), workshop participants discussed the characteristics of low-income multifamily housing to determine which factors were most important for the survey stratification. The research team, Study Team, and workshop participants hypothesized there might be a difference in decision making practices within properties where tenants or owners received some rent assistance, such as Section 8 housing or other housing vouchers, and, properties that are "market rate" where no subsidies are received. In addition, workshop participants anticipated potential differences in decision making and housing characteristics between housing units of different sizes. The group agreed that differences in decision making would not be related to the IOU service territory in which the property was located. Therefore, sample strata were based on ownership and size of the property management/owner and they were not based on IOU service territories.

The sampling plan for the survey of owners and operators of low-income multifamily properties used a two dimensional design. Two strata were defined by market rate and assisted housing and three strata were defined by the size of the property management company operating a particular property (that is, the number of apartment units owned or managed in California). The sampling plan for these surveys was designed to represent the population. Table 22 shows the sampling plan and the number of surveys completed. Of the 124 surveys completed, 73 were with market rate property managers and 51 with rent-assisted property managers.

Table 22. Overview of the Sampling Plan and Responses Achieved

Sector	Size	Planned Completes	Completed Surveys
Assisted	5 to 25 Units	50	2
	26 to 249 Units	50	14
	250 or More Units	50	35
Market	5 to 25 Units	50	36
	26 to 249 Units	50	26
	250 or More Units	50	11
Total		**300**	**124**

Sector Strata

The *sector* strata differentiate between market rate housing and assisted housing. To target the survey to properties known to serve the limited income residential market, a list of properties that received housing assistance provides certain access to appropriate respondents. Moreover, housing that participated in assistance programs may be systematically different than housing that has not. However, a sizeable portion of the multifamily housing market serving low-income households has not participated in any assistance programs. To capture this sub-sector, a more general sample frame was needed. That was provided by a market rate stratum, i.e. reflecting buildings whose tenants pay the going rate and are not subsidized.

The sampling frame for the rent-assisted housing stratum was a database built from lists of rent-assisted properties. We selected one record for each unique address in the database based on the most current and/or most complete record. For the market rate stratum, the sample frame was composed of information for common area accounts provided by the IOUs. The market rate sampling frame was comprised of contact names from master or common metered accounts in buildings with at least one CARE recipient. Including the CARE criteria provided a sample likely to be composed of buildings with low-income residents.

Size Strata

Decision-making about multifamily properties is closely related to the size of the companies that own and operate the properties. This was in evidence in results from the survey of multifamily property owners and managers conducted for the MFEER program process evaluation.[8] As expected in the MFEER study, larger companies were more difficult to survey and collect information. Yet larger companies manage far more properties than smaller ones. Thus, it was critical that the sample for the Multifamily study capture a cross section of company sizes.

Property owners and managers were screened for the Multifamily Study survey, and asked how many properties were managed by their company. Within each of the sub-sector strata (market rate and rent-assisted), the survey sampling plan included a quota of 50 for each of three size strata, for a total of 150 completes across the three size strata. The size strata captured the smallest 45% of companies, the middle 45% of companies relative to size, and the largest 10% of companies. Based on research conducted for the MFEER evaluation, these three categories represented companies managing no more than 25 units, more than 25 but less than 250 units, and 250 units or more.

[8] Eric Rambo and Linda Dethman. April 15, 2013. "2010-2012 PG&E and SCE Multifamily Energy Efficiency Rebate Program (MFEER) Process Evaluation and Market Characterization Study." CALMAC # PGE301.01, pp. 23-26.

Generalizing to the Population of Low-Income Multifamily Properties

To generalize to the entire population of properties, we used post-weighting of the results to account for the sample design. Weighting the results based on population proportions allows the combined estimate to reflect the relative prevalence of the two sub-sectors. The sector weights are as shown in Table 23.

Table 23. Survey Weights

Sector	Sector Weight	Size (Number of Apartment Units)	Design Weight by Size Strata	Combined Weight
Assisted	0.12	5 to 25 Units	0.45	0.054
		26 to 249 Units	0.45	0.054
		250 or More Units	0.10	0.012
Market	0.88	5 to 25 Units	0.45	0.396
		26 to 249 Units	0.45	0.396
		250 or More Units	0.10	0.088

The weight applied to the data is a multiplier for each response that renders the overall distribution of responses across the strata equal to the distribution in Table 23. For instance, in the assisted sector for respondents owning or operating 5 to 25 units, we completed 2 surveys, which is 1.6% of the total number of completed surveys (124). In the population, however, this group makes up 5.4%. So, the weight for each response in this category is 1.6/5.4 = 3.3.

Uncertainty

The difficulty we had fulfilling the sample plan makes it difficult to estimate the degree of certainty associated with survey results. If we assume the survey represents a simple random sample of 124 building owner and managers, the sampling error associated with an estimated proportion of 0.5 would be +/- 0.073, or a relative precision of about 15%. For the assisted sub-sample, with 51 completed surveys, the sampling error associated with an estimated proportion of 0.5 would be +/- 0.112, or a relative precision of about 22%; for the market rate sub-sample of 73 it would be +/- 0.095, or a relative precision of about 19%. The design would contribute additional uncertainty, especially where the strata had substantially different values on a given item. The degree of uncertainty we cannot estimate results from non-response bias. The difficulty we had completing surveys undermined our effort at randomization, on which rest classical statistical theory and thus the estimates of precision just offered. Thus, while we believe our results are good indicators of central tendency, they should be interpreted with caution and in conjunction with other, supporting information.

Data Sources

Cadmus compiled call lists for surveys with property owners and managers of affordable housing and market rate housing from multiple sources.

Affordable Housing Sources

Cadmus utilized public sources to sample property owners and managers for the survey. These sources included participants in the US Department of Housing and Urban Development's (HUD) Section 8 rental subsidy program. Property owners and managers in the Low-income Housing Tax Credit (LIHTC) program administered by the California Tax Credit Allocation Committee (CTCAC) were included in the sample frame. These lists came from two sources; HUD and CTCAC. Also included was a list from the US Department of Agriculture for participants in the California Rural Development program. California Housing Partnership Corporation provided records with contact information of key decision makers. Cadmus merged the lists for a combined total of 7,598 records. Removing property address duplicates left 2,365 records. The sample call list was randomized before dialing. Following the pre-test, the list was further filtered to select unique management contacts to develop a list of 367 unique contacts. This call list was randomized before dialing in the final round of calls.

Market Rate Sources

IOUs provided customer data to compile a sample of property owners and managers for the market rate sample. To identify building managers or owners, Cadmus used contact information from master or common-area meter accounts in buildings with at least one CARE recipient. To identify this intersection, Cadmus required both individual tenant records with an identifier of CARE status, common area and master-meter account records. The customer data provided varied by IOU. A brief description of each source is outlined below.

- SCG provided a dataset with both individual-unit and master or common-area meters. The dataset included a CARE flag for individual customers.
- PG&E did not provide a full customer dataset but did provide a list of their customers (addresses only) on the CARE rate. Cadmus used data from a 2011 MFEER study as a source for master and common-area meters.
- SCE provided individual customer records, including CARE rate flags. Cadmus used the 2011 MFEER study data as a source for master and common-area meters.
- SDG&E provided data on master metered properties including whether these meters were on a CARE rate. They were not able to provide data on common area meters of multifamily buildings.

To most accurately match individual-unit addresses with building addresses, Cadmus ran every address record through a Graphical Information System (GIS), which returned a "matched address" for each record. This, in effect, stripped unit numbers and formatting differences from the address records, making them as consistent as possible. Using these "matched" addresses, Cadmus identified common-area or master-meter accounts in buildings with at least one CARE participant, and used these records as the dataset from which to sample. Identifying buildings with at least one CARE participant was intended to reduce the total number of records to those more likely to lead to low-income multifamily buildings.

The last steps in generating the market-rate sample involved filtering the remaining records to include only properties in the targeted census tracts (that is, census tracts identified as likely to have a large number of low-income households in multifamily buildings), removing contacts that were included in

the subsidized housing sample (rent-assisted sector), and removing duplicate contacts from the remaining set. This de-duplication of records identified duplicate property addresses. After removing these records, 11,714 records remained. Following the survey's pre-test additional duplicate records were removed. This de-duplication of records was achieved by standardizing the format of the contact phone numbers and randomly selecting one record from each group of distinct phone numbers. Finally, duplicate contact names were removed, first by exact matching and then by a review with human eyes.

The compilation of records from each IOU and the attrition of records as the sample frame was developed are shown in Table 24. The sample frame started with about 88,000 records. Following the pre-test, Cadmus removed properties with the same contact phone numbers and randomly selected one record from each group of distinct phone numbers. This accounted for over half the original sample frame leaving fewer sample records. After removing records as discussed above, about 5,300 market rate records were included in the final sample frame used in the full launch of survey data collection (Table 27).

Table 24. Market Rate Sample

Dataset	Count
Initial Dataset	
SCG common or master meters in buildings with a CARE recipient	3,701
PGE common meters in buildings with a CARE recipient	55,477
SCE common meters in buildings with a CARE recipient	28,243
SDGE CARE-flagged master meters	643
Total	**88,064**
Filters Completed After Pre-test	
Filtering for missing or bad phone numbers	74,155
Filtering out affordable housing properties	71,805
Identify properties within targeted census tracts	8,891
Identify distinct (unique) phone numbers	5,562
Final Sample Frame of unique customer names	**5,377**

Survey Administration Process

The sample frame includes both the market rate and affordable housing samples. The pre-test sample frame included 11,714 market rate records and 2,365 rent-assisted records.

During the pre-test phase, 34% of the 14,079 records were attempted. Some of the records dialed in the pre-test were duplicates and removed from the sample frame before the full launch of the study. Removing duplicates and properties with the same owner or property manager reduced the possibility that the same owner was called for different properties. (For details on the outcome of the records in the sample frame, see Table 95 and Table 97. Table 96 contains details about the convenience sample, described on the next page.)

Table 25. Sample Frame Attrition, Pre-Test

Pre-Test	Sample Frame	Number of Non-Final Records	Number of Records Finalized
Initial Number of Records (Rent-assisted and Market Rate sample, but not including convenience sample)	14,079		
Number of Records Attempted	4,821		
No Answer, Answering Machine, Phone Busy, Callback		3,362	
Non-Working Phones, Not Multifamily Property			635
Refusal and Terminate			537
Ineligible			246
Language Barrier			0
Complete in Pre-Test			41
Not Attempted		9,258	
Duplicates Removed from records dialed and not attempted	7,494		

Convenience Sample

In addition to the sample compiled from the IOU customer data for the market rate housing sector, a convenience sample was compiled. This included additional records of multifamily property owners provided by SCE and records obtained through an internet search of housing associations. This search referenced MSA websites to find market-rate and low-income apartment building owners or managers to survey. The internet search included business licensing pages, MSA Treasury Office pages, rental housing pages, and business directory pages to find market-rate apartment building listings.

The search focused on the low-income and affordable housing pages of each MSA to gather low-income apartment building listings. These lists included low-income and market-rate apartment listings for Anaheim, Fresno, Los Angeles, San Diego, and San Francisco. The surveyors attempted the records from the Anaheim listings and did not complete any survey. A visual inspection of the remaining lists concluded that many of the records contained duplicate entries based on contact information. The survey firm did not attempt any of the additional lists.

Table 26 summarizes the sample frame and final disposition of records included in this convenience sample. Only three completed surveys can be attributed to this sample.

Table 26. Disposition of Convenience Sample

Convenience Sample	Sample Frame	Number of Non-Final Records	Number of Records Finalized
Sample Frame	722		
Removed duplicates / Missing Phone Numbers	606		
Records Sent to Survey Subcontractor	116		
Number of Records Attempted	114		
No Answer, Answering Machine, Phone Busy, Callback		83	
Not Attempted		2	
Non-working Phones, Not Multifamily Property			12
Refusal and Terminate			7
Ineligible			8
Language Barrier			1
Completed Survey			3

Records in the sample frame were randomized before dialing. Table 27 shows the final disposition of records dialed with the sample frame of 6,466 records, including the convenience sample, available for the full survey launch. This total number of records includes 5,377 market rate records, 367 rent-assisted records, and 722 convenience sample records.

Table 27. Sample Frame Attrition, Full Launch

Full Launch (including Convenience Sample)	Sample Frame	Number of Non-Final Records	Number of Records Finalized
Sample Frame	6,466		
Removed duplicates manually	853		
Records Sent to Survey Subcontractor	5,613		
Number of Records Attempted	4,893		
No Answer, Answering Machine, Phone Busy, Callback		3,168	
Not Attempted		604	
Non-working Phones, Not Multifamily Property			980
Refusal and Terminate			231
Ineligible			341
Language Barrier			90
Complete in Full Launch			83
Total Number of Completed Surveys			**124**

The survey process was difficult and experienced several roadblocks that hampered completion of the targeted number of surveys. The first was the large number of duplicates and numbers of properties with the same owner or property management firm. These needed reducing so that the call list included unique phone numbers. Two other issues were pervasive throughout the survey's fielding period. One

was the number of outdated phone numbers. Some phone numbers did not belong to multifamily housing properties or were non-working numbers. This accounted for one-quarter of the remaining records attempted. Another issue was the difficulty reaching respondents. Half of the calls did not result in reaching the intended property manager or owner because they were not available when the call was made and did not call back.

To qualify for the survey, screening questions confirmed the property's tenants were low-income, there were at least 5 apartment units in one building (the definition of multifamily), and that the respondent was the person making decisions about building and equipment upgrades to the property and rental units at the property.

This screening identified ineligible records. Some were ineligible to participate because the respondent did not know or did not have low-income tenants living on the property or any other properties in California. Some properties were ineligible for the research because their property did not have a single building with 5 or more units. All types of ineligible properties accounted for about 9% of the sample frame.

Over 10% of the calls ended when the respondent refused the survey. This was due to many reasons but one was that some property owners and managers were uncomfortable discussing the income level of their tenants. This meant it could not be confirmed the respondent met the criteria for the targeted population. Table 28 shows the percentage of calls for each outcome. Together, these issues made it difficult to reach the intended goal for completed surveys.

Table 28. Final Survey Call Outcomes*

	Total Sample Frame (n=14,801)	Attempted Sample Records (n=6,466)
Duplicates Removed From Sample Frame	56%	N/A
No Answer, Answering Machine, Phone Busy, Callback	22%	50%
Non-Working Phones, Not Multifamily Property	11%	25%
Refusal and Terminate	5%	12%
Ineligible	4%	9%
Language Barrier	1%	1%
Complete	1%	2%

* The number of sample records includes all records attempted. Some of the non-final records attempted in the pre-test phase were removed from the sample frame in the full launch of survey data collection because they were duplicates.

Appendix G. Research Methodology for Stakeholder Interviews

Between June and September 2013, the Cadmus team conducted interviews with: (1) low-income stakeholder and advocacy groups working with affordable and market-rate multifamily housing, and (2) multifamily building owners and managers.

Objectives

We collected information about the respondents' constituency, financing considerations for multifamily building improvements, and discussed concerns about participation in the ESA Program. We also asked for suggestions for data sources or others to contact for interviews and surveys, and recommendations for research topics to inform the study. These qualitative interviews represent the perceptions of the respondents and do not denote quantitative research findings.

Methodology

Sample Selection

Interviews included representatives from both the affordable- and market-rate housing sectors to strive for a balance of viewpoints. It is important to note that these qualitative interviews were not designed to represent a statistically accurate sample of the California multifamily market. They represent a diversity of views and highlight the similarities and differences between the various stakeholder and advocacy groups. The respondents' views cannot be classified as belonging solely to affordable- or market-rate housing groups.

Cadmus conducted 16 separate interviews with 18 people from 14 different stakeholder organizations. Of these, eight organizations had attended the Multifamily Segment Study public workshop in March and six had posted comments to Decision 12-08-044.

Stakeholders were chosen through a process of reviewing the following:

- Formal documents designated as "comments" posted to the Commission Decision (D.) 12-08-044 on the Commission website[9]
- Roster of attendees from the Multifamily Segment Study public workshop on March 5, 2013
- Suggestions provided by attendees of the Multifamily Segment Study public workshops on March 5 and September 25, 2013
- Multifamily Executives Magazine's 2013 Top 50 Owners List
- Multifamily housing associations lists
- A.1111-05-017 Service List[10]

[9] CPUC, Filed October 26, 2012, contact list for posting information regarding scheduled hearings.

[10] Ibid

We first interviewed stakeholders who posted comments to the Decision (D.12-08-044) and/or attended the public workshop in March because they were familiar with the ESA Program, the Decision, and the Low-Income Multifamily Segment Study. These stakeholders proactively offered to participate in interviews, provide data, and suggested others for interviews.

We then used search engines to find stakeholders from various California associations to interview. After identifying apartment associations, housing associations, rental property associations, property owner associations, and affordable housing associations within each MSA city or county, we recorded the contact information for each association executive. (In total, we identified 24 unique association executives.) We targeted seven market rate properties from the multifamily housing associations list.

Using the *Multifamily Executives Magazine* list, we targeted nine with market-rate properties and significant presence in California. Scheduling interviews with representatives of market-rate housing proved more challenging than with those representing affordable housing. This was due, in part, to difficulties locating the correct person within an organization to interview. As a result, the interviews do not represent the entire California multifamily market but rather a sub-segment consisting primarily of affordable housing organizations or advocates.

Respondents' constituents reside in or manage affordable housing, market rate housing, or both. Most respondents could speak about both affordable- and market-rate multifamily building issues because they serve both groups. Stakeholder groups interviewed are listed in Table 29 (in alphabetical order).

Table 29. Stakeholder and Advocacy Groups Interviewed

Stakeholder	Rent Categories*
Bridge Housing	Affordable housing; some market rate
California Association of Housing Authorities	Affordable housing
California Housing Partnership Corporation	Affordable housing
Division of Ratepayer Advocates, CPUC	Both
Essex Property Trust	Market rate
Mercy Housing	Affordable housing
National Asian American Coalition	Affordable housing
National Consumer Law Center	Both
National Housing Trust	Affordable housing; some market rate
Riverstone Residential Group	Both
San Diego County Apartment Association	Both
StopWaste	Both
The East Los Angeles Community Union (TELACU)	Affordable housing
US Department of Housing and Urban Development	Affordable housing

* Rent categories specified by interviewee.

All respondents serve clients or manage multifamily properties with five or more units. Respondents reported that they worked with small (25 or fewer units), medium (26 to 249 units), or large (250 units or more) multifamily properties. The majority represent medium-size properties.

Data summarizing the number of properties and number of units owned or managed by respondents were available from only five firms. Table 30 shows the range of the numbers of properties and apartment units within these five.

Table 30. Number of Buildings and Apartment Units Represented Five Interview Respondents

Size of Properties	Number of Properties	Number of Units
Small (25 or fewer units)	34	521
Medium (26-249 units)	242	20,500
Large (250 or more units)	98	20,973
Total	**374**	**41,994**

Appendix H. Eligible Measures for California Programs Targeting the Multifamily Sector

Table 31. ESA Program Eligible Measures

Measure Category	Measure[1]
Heating Systems	Furnaces
Cooling Measures	A/C Replacement - Room
	A/C Replacement – Central
	A/C Tune-up - Central
	A/C Services – Central[2]
	Heat Pump
	Evaporative Coolers
	Evaporative Cooler Maintenance[2]
Infiltration & Space Conditioning	Envelope and Air Sealing Measures
	Duct Test and Sealing
	Attic Insulation
Water Heating Measures	Water Heater Conservation Measures
	Water Heater Replacement - Gas
	Water Heater Replacement – Electric[2]
	Tankless Water Heater – Gas[2]
	Tankless Water Heater – Electric[2]
Lighting Measures	CFLs
	Interior Hard wired CFL fixtures
	Exterior Hard wired CFL fixtures
	Torchiere
Refrigerators	Refrigerators -Primary
	Refrigerators – Secondary[2]
Pool Pumps	Pool Pumps
New Measures	Forced Air Unit Standing Pilot Change Out
	Furnace Clean and Tune
	High Efficiency Clothes Washer
	Microwave
	Thermostatic Shower Valve
	LED Night Lights
	Occupancy Sensor
	Smart Power Strips

Measure Category	Measure[1]
Pilots	A/C Tune-up Central Home[2]
	Interior Hard wired CFL fixtures[2]
	Ceiling Fans[2]
	In-Home Display[2]
	Programmable Controllable Thermostat[2]
	Forced Air Unit[2]
	Microwave
	High Efficiency Clothes Washer[2]

1. Measures listed in Table 2 of IOU ESA Program PY 2012 Annual Reports.
2. Measure not installed in 2012.

Table 32. CSD Program Eligible Measures

Measure Category	Measure
Appliances	Refrigerator Replacement
	Microwave
Building Envelope	Knee-wall Insulation
	Weatherstripping (Other)
	Weatherstripping (Hinged Door)
	Floor Foundation Venting
	Floor Insulation
	Mechanical Ventilation
	Shade screens
	Shutters
	Storm Windows
	Tinted Window Film
	Wall Insulation, Stucco and Wood
	Windows for EE
Heating and Cooling	Thermostat
	Evap Cooler Vent Cover, Interior
	Cooling Replacement for EE
	Heating Replacement for EE
Home Repair	Glass Replacement - Catastrophic leaks
	Minor Envelope Repair
	Minor Home Repair
	Windows - Catastrophic leaks only
Other	Ceiling Fans

Measure Category	Measure
Water Heating	Hot Water Flow Restrictor
	Water Heater Blanket
	Water Heater Pipe Wrap
	Exterior Water Pipe Wrap
	Timer, Electric Water Heater
	Solar Water Heating

Table 33. MFEER Eligible Measures[1]

Measure Type	Measure
Lighting	Screw-in CFL Reflector bulbs (ENERGY STAR® Qualified)
	Interior LED Lamps
	ENERGY STAR® LED Recessed Down Light <= 25 Watt
	Interior CFL Fixtures (ENERGY STAR® Qualified)
	Low Watt T8 or T5 or Lamps w/electronic ballasts
	Exterior CFL fixtures (ENERGY STAR® Qualified)
	Exterior LED lamps
	Exterior LED fixtures
	Occupancy sensors
	Photocells
	Ceiling Fans (ENERGY STAR® Qualified)
	LED Pool and Spa lighting
	Vending Machine Controls
	Exterior Induction Fixture <=400 Watts Base Case
Building Envelope	High Performance Dual-Pane Windows
	Cool Roof
	Attic and/or wall insulation
Water Heating	Electric storage water heaters
	Electric Heat Pump storage water heaters
	Central system natural gas water heaters/boilers
	Natural gas water heater and/or boiler controllers
	Natural gas storage water heaters
	Tankless Water Heaters
	Pool Heaters
	Low Flow Shower Head

Measure Category	Measure
HVAC	Package terminal air conditioners & heat pumps
	Unitary AC Units
	Central Natural Gas Furnaces
	HVAC Quality Maintenance
	Brushless Fan Motor for Central AC
	Evaporative Coolers
	Programmable Thermostats
	Wall Furnaces
Appliances	Refrigerators (ENERGY STAR® Qualified)
	High-efficiency Clothes Washers
	ENERGY STAR® Dishwashers
	Cold Water Clothes Washers
Pumping	Variable Speed Pool Pumps
	Programmable Thermostats (Common Areas only)
	Demand Control for Centralized Water Heater Recirculation Pump

1. The measures listed reflect all measures listed in 2013-2014 MFEER PIPs, some measures vary by IOU.

Table 34. Whole Building Program Eligible Measures[1]

Measure Type	Measure
Domestic Hot Water (Individual and Central)	Boiler or DHW replacement – Must meet current T-20 standard
	Central system natural gas water heaters
	Circulation pump
	Combined space and water heater
	Condensing gas water heater
	Demand Control for Centralized Water Heater Recirculation Pump
	DHW heaters/boilers
	DHW tank insulation
	Electric storage water heaters
	Faucet Aerator
	Heat pump DHW
	Low flow water fixtures
	Natural gas storage water heater
	Pipe insulation
	Tankless/instant DHW
	Water Heater Blanket
	Water heater repair & replacement
HVAC	A/C equipment replacement – Must meet current T-20 standard
	A/C Tune-up (Central AC)
	AC Time Delay
	Bathroom fans

Measure Type	Measure
	Central natural gas furnace
	Chillers
	Cogeneration systems
	Controls optimization (OA reset, zone reset)
	Cooling towers
	Duct insulation
	Duct sealing
	Ducted evaporative cooling
	Ductless air-conditioning for common areas
	Evaporative Coolers
	Evaporative coolers repair & replacement
	High performance rooftop unit
	HRV
	HVAC pipe insulation
	HVAC Quality Maintenance
	HVAC system commissioning
	Natural gas furnace
	Natural gas hydronic heat boiler/space heating hot water boilers/hydronic systems
	Natural gas steam heat boiler/space heating low pressure steam boilers
	Package terminal air conditioner
	Package terminal heat pump
	Package terminal heat pumps
	Premium efficiency motors (ECM included)
	Programmable thermostat
	Refrigerant charge verification
	Room air conditioner
	Space cooling equipment
	Space heating equipment
	System airflow verification
	System fan size/hp
	System fan wattage verification
	Tank insulation
	Thermostatic radiator valves (TRV)
	Unitary AC Units
	Variable refrigerant flow for common areas
	Variable speed motor
	VAV systems
	Ventilation schedules
	VFD controls for CHW, HW, CW pumps
	VFD controls for cooling tower fans
Appliances	Clothes Dryer

Measure Type	Measure
	Clothes washer (in-unit and common area)
	Cold Water Clothes Washers
	Dishwasher (in-unit)
	ENERGY STAR® Refrigerator
	Microwave-(displacing gas or electric oven use)
	Vending Machine Controls
	Advanced HID lighting for site lighting
Lighting	Advanced lighting controls
	Bi-Level lighting
	Ceiling fans
	CFL bulb (screw-in)
	Cold cathode lamps
	Common area lighting fixtures – high efficacy hardwired fixtures
	Daylighting
	De-lamping
	Dwelling unit lighting fixtures – high efficacy hardwired fixtures
	Exterior CFL fixtures (ENERGY STAR® qualified)
	Exterior LED fixtures
	Exterior LED lamps
	Interior CFL fixtures (ENERGY STAR® qualified)
	Interior LED fixtures (ENERGY STAR® qualified)
	Interior LED lamps (ENERGY STAR® qualified)
	Landscape/parking lighting
	LED exit signs
	LED interior lighting
	LED night lights
	LED pool and spa lighting
	LED site lighting
	Lighting controls – Occupancy sensor, photo sensor, or dimmer switch
	Linear fluorescent fixtures and bulbs
	Outdoor lighting retrofits – high efficacy hardwired fixtures
	Photocells
	Screw-in CFL reflector bulbs (ENERGY STAR® qualified)
	T5 or Lamps w/electronic ballasts
	Task lighting
	Timer
	Torchiere

Measure Category	Measure
Building Shell	Air sealing
	Attic insulation (with attic plane sealing)
	Cool roof
	Floor insulation
	High performance dual-pane windows
	Overhangs
	Radiant barrier
	Wall insulation
	Weather-stripping
	Window shading – permanent, non-retractable
	Windows
Swimming Pools	Filtration pump and motor
	Pool booster pump
	Pool and spa heater
Other	Gearless Elevators

1. The measures listed are those included in IOU EUC MF Path and REN PIPs for 2013-2014. This list is not exhaustive: PIPs specify that eligible measures are not limited to those listed.

Appendix I. Financial Solutions Catalog

Table 35. Financial Solutions Catalog

Name of Program/ Product	Sponsor	Region	Type	Targets Low-Income	Program Size	Individual Project Amount	% of Project Fundable	Eligibility	Restrictions on Measures (if Applicable)	EE or RE	# Projects Complete	Description	Website	Representative Project
Green Finance Plus	Fannie Mae	US	Financing	Yes	Not available.	No minimum or maximum loan amount. Loans above $50 million require HUD consent.	Not available.	Green Refinance Plus loans are available for existing properties that are 10 years or older and that will meet MAH income and rent restrictions going forward, nationwide. Borrowers must track energy and water using ENERGY STAR portfolio manager and submit the ENERGY STAR performance report annually	Standard third-party reports – Green Physical Needs Assessment (GPNA), Appraisal, and Phase I Environmental Assessment - are required. The GPNA must contain an assessment of a property's physical needs, an energy audit and identification of cost effective opportunities for increasing energy and water efficiency, and reducing operating and capital costs.	EE/RE	Not available.	The Green Refinance Plus execution for Multifamily Affordable transactions provides additional proceeds to support the green retrofitting and general renovation of existing Affordable properties. 4-5% more proceeds than our regular DUS Affordable preservation execution, to support energy retrofitting and other needed renovations.	https://www.fanniemae.com/content/fact_sheet/grnrefiplus.pdf	Not available.
Green Affordable Housing Preserva-tion Loan Fund	National Housing Trust, Inc.	US	Financing	Yes	Loans provided on a case by case basis	$50,000 - $500,000	The loan will be sized to be repaid by a combination of existing cash flow and anticipated savings produced by the conservation measures.	Existing multi-family affordable housing	Measures designed to reduce energy costs and make properties environmentally sustainable. At least 75% of the units are occupied by residents that are at or below 80% of area median income, **and** either at least 20% of the units are occupied with residents at 50% of area median income; or 40% of the units are occupied at 60% of the area median income.	EE/RE	4 loans funded so far, all for new construction.	Offers subsidized financing for multi-family building owners to incorporate green elements into existing buildings. Financing can be applied to both planning and implementations of projects.	http://www.nhtinc.org/green_loan_fund.php	Not available.

Name of Program/ Product	Sponsor	Region	Type	Targets Low-Income	Program Size	Individual Project Amount	% of Project Fundable	Eligibility	Restrictions on Measures (if Applicable)	EE or RE	# Projects Complete	Description	Website	Representative Project
Rural Development Multi-Family Housing Energy Efficiency Initiative	USDA Rural Development	US (Section 516 funds can be used for off-farm housing for farm workers in urban areas. All other projects must be in non-urban areas, which cover most of CA.*	Financing and grants	No	Varies annually. Initiative applies to Section 515 Rural Rental Housing Program for New Construction, Section 514 Farm Labor Housing Loans and Section 516 Farm Labor Housing Grants for Off-Farm Housing, Section 522 Housing Preservation Grants, and Sections 514, 515 and 516 Multi-Family Housing Revitalization Demonstration Program.	This initiative does not have funds set aside for it, but applicants to several Multi-Family Housing programs receive priority scoring if they incorporate energy efficiency aspects to their projects.	This initiative does not have funds set aside for it, but applicants to several Multi-Family Housing programs receive priority scoring if they incorporate energy efficiency aspects to their projects.	Varies by funding source, but options available for private, non-profit, government, and tribal organizations.	Recognizes green construction, energy conservation, and energy generation measures in new and existing housing structures.	EE	At least 7 projects in CA.	Gives priority to projects applying to other USDA loan or grant programs when they incorporate energy efficiency or conservation in to the project scope.	http://www.rurdev.usda.gov/program_details.html	http://www.rurdev.usda.gov/project_MC.html
Mark-to-Market (M2M) Green Initiative Pilot	HUD	US	Grant/ Loan Restruc-turing; Perform-ance Incentive for having LEED profess-sional involved with property manage-ment	Yes	Not available.	Not available.	Not available.	Existing affordable housing owners currently engaged in M2M (HUD Section 8 portfolio) and those taking out new M2M loans	EE and water-saving measures	EE	Not available.	Program provides favorably termed loans to finance cost of EE and water saving measures in existing affordable multifamily housing.	http://www.hud.gov/offices/hsg/omhar/pages/green/greenini.pdf	Not available.

* Non-urban area map: http://eligibility.sc.egov.usda.gov/eligibility/welcomeAction.do)

Name of Program/ Product	Sponsor	Region	Type	Targets Low-Income	Program Size	Individual Project Amount	% of Project Fundable	Eligibility	Restrictions on Measures (if Applicable)	EE or RE	# Projects Complete	Description	Website	Representative Project
Business Energy Invest-ment Tax Credit	IRS	US	Tax Credit (Federal Corporat e Tax)	No	10-30% of installation expenditure	10-30% of installation expenditure	Not available.	Commercial property	Installation of renewable energy generation equipment	RE (includi ng CHP)	Not available.	Corporations installing new renewable energy generation equipment are eligible for the credit. 30% credit for solar, fuel cells, small wind, and technologies eligible for the Production Tax Credit; 10% credit for geothermal, CHP and microturbines. Must be in service by 2016 to qualify.	http://ener gy.gov/savi ngs/busine ss-energy-investment -tax-credit-itc	Not available.
California FIRST (PACE)	Californi aFIRST	Over 100 cities and counties throughout the state, as well as statewide	Financing	No	$50,000+ per loan, "hundreds of millions" in available capital	$50,000+ per loan, "hundreds of millions" in available capital	100% upfront financing for qualified energy upgrades	Multifamily with 5+ units; ASHRAE level 2 audit	Energy and water improvements that protect against rising utility costs	EE/RE	Not available.	100% financing for energy retrofits to commercial properties, where the financing payment is made as an assessment to the property and paid back on the tax bill.	https://cali forniafirst. org/proper ty_owners_ overview	Not available.
CalHFA Preserva-tion Loan Program	CalHFA	State of California	Financing	Yes	Unknown; loans in excess of $10 million may require additional levels of affordability	Minimum 115% for debt service coverage ratio	Lesser of 90% of restricted value or 80% of development costs	Available to for-profit, non-profit, and public agency sponsors	A Green Physical Needs Assessment is required, but financing can apply to acquisition and general building retrofit.	EE	New program started in April, 2013. No projects have been completed yet under this new program. Over the past 30 years, CalHFA's Multifamily division has invested more than $2 billion for the construction and preservation of 36,000 affordable rental housing units assisting low-income Californians.	Financing to support rehabilitation of low-income multi-family housing. Credit-enhanced loans through FHA also available.	http://ww w.calhfa.ca .gov/multif amily/finan cing/terms heets/inde x.htm	Not available.

Name of Program/ Product	Sponsor	Region	Type	Targets Low-Income	Program Size	Individual Project Amount	% of Project Fundable	Eligibility	Restrictions on Measures (if Applicable)	EE or RE	# Projects Complete	Description	Website	Representative Project
Multi-family Portfolio Loan Prepay-ment Program	CalHFA	State of California	Financing Prepayment	Yes	Unknown; loans in excess of $10 million may require additional levels of affordability	Loans in excess of $10 million may require additional levels of affordability	Not available.	Borrowers through a CalHFA program	Considers "green rehabilitation" as a favorable qualification. A Green Physical Needs Assessment is required.	EE	New program started in April, 2013. No projects have been completed yet under this new program. Over the past 30 years, CalHFA's Multifamily division has invested more than $2 billion for the construction and preservation of 36,000 affordable rental housing units assisting low-income Californians.	Allows for early re-payment of CalHFA multi-family portfolio loans for rehabilitation of low-income multi-family housing.	http://www.calhfa.ca.gov/multifamily/financing/termsheets/index.htm	Not available.
Property Tax Incentive	State of Califor-nia	State of California	Tax Exclusion (State Property Tax)	No	100% of system value (75% for dual-use systems)	100% of system value (75% for dual-use systems)	Not available.	Any property	Solar technologies only	RE	Not available.	The State of California allows a property tax exclusion for certain types of solar energy equipment installed between 1999 and 2016.	http://www.boe.ca.gov/proptaxes/gase.htm	Not available.
Multi-family Affordable Solar Housing (MASH)	State of Califor-nia	State of California	Rebate	No	$108 million through 2015, now fully subscribed. Individual incentives range from $1.90 - $2.80 per watt depending on whether common area load or tenant load is offset.	Individual incentives range from $1.90 - $2.80 per watt depending on whether common area load or tenant load is offset.	Not available.	Multi-family	Solar PV only	RE	6,200 tenant units participating in Virtual Net Metering thanks to the MASH program.	**NOTE: Incentives have been fully subscribed for all three program administrators and waitlists have been established.** Provides fixed rebates for solar PV system installed on multi-family properties, based on the size and expected performance of the solar PV system installed.	http://www.cpuc.ca.gov/PUC/energy/Solar/mash.htm	Not available.

Name of Program/ Product	Sponsor	Region	Type	Targets Low-Income	Program Size	Individual Project Amount	% of Project Fundable	Eligibility	Restrictions on Measures (if Applicable)	EE or RE	# Projects Complete	Description	Website	Representative Project
Bay Area Multi-family Retrofit Loan Fund	LIIF	San Francisco Bay Area	Financing	Yes	Total program size is $4,000,000; the program had a 1 year origination period and an 11.5 year term	Maximum of $500,000	25% funded by Bay Area Multifamily Retrofit Loan Fund, 25% funded by their partners, Enterprise Community Partners	Affordable housing developers and owners in the nine-county Bay Area seeking to retrofit existing buildings to make them greener, more efficient and less costly are eligible.	Measures should be identified through the Bay Area Multifamily Fund's free audit	EE	5 properties financed through BAM, for a total of 429 units retrofitted	Offers audit services and customized financing for energy efficiency upgrades to affordable multi-family housing.	http://www.liifund.org/products/community-capital/capital-for-affordable-housing/bay-area-multifamily-fund/	Not available.
LEED Incentive Program	Burbank Water & Power	Burbank, CA	Rebates	No	Up to $30,000 depending on LEED level	Up to $30,000 depending on LEED level	Not specified.	Commercial, Nonprofit, Multi-Family Residential	Not available.	EE/RE	Not available.	Provides rebates up to $30,000 provided by Burbank Water & Power for LEED certification levels of Certified or better.	http://www.burbankwaterandpower.com/incentives-for-businesses/leed-incentive-program	Not available.
Energy Solutions	Burbank Water & Power	Burbank, CA	Rebates	No	25% of measure cost, up to $100,000 per building	25% of measure cost, up to $100,000 per building	Up to 25% of the installed cost of the measure.	Commercial	Not available.	EE/RE	Not available.	Provides rebates up to 25% of the cost of the measures installed for businesses that conduct a whole-building energy audit.	http://www.burbankwaterandpower.com/incentives-for-businesses/energy-solutions-business-rebate-programs	Not available.

Name of Program/ Product	Sponsor	Region	Type	Targets Low-Income	Program Size	Individual Project Amount	% of Project Fundable	Eligibility	Restrictions on Measures (if Applicable)	EE or RE	# Projects Complete	Description	Website	Representative Project
Energy Upgrade California Multi-family Program, Bay Area	BayREN/ StopWaste	Bay Area, CA	Rebates and free technical assist-ance	No	$7.3 million per proposed decision approving 13/14 EE budgets (application 12-07-001)	$750 rebate per unit upgraded up to a maximum of $300,000. Also, free energy project consultation of a value up to $5,000.	20 – 40%	5 or more attached dwelling units. Located in 9-county Bay Area. Affordable housing, market rate rentals, condominiums, other ownership configurations are eligible. Program services and funds available to eligible participants on a first-come, first-served basis. The program runs from July 2013 through December 2014.	The program assists in planning energy saving improvements designed to save a minimum of 10% of a building's energy usage.	EE/RE	Not available.	Energy Upgrade California in the Bay Area offers free energy planning assistance and cash rebates for multifamily properties that undertake energy and green upgrades.	https://multifamily.energyupgradeca.org/local#bayarea	https://multifamily.energyupgradeca.org/#case_studies_tab
Energy Upgrade California Multi-family Program, Los Angeles County	SoCal REN	Los Angeles County, CA	Rebates and free technical assist-ance	No	$9.5 million per proposed decision approving 13/14 EE budgets	Free consultation: $5,000 valueAssessment incentive: $5,000 for 5-20 unit building, $10,000 for 21-50 unit building, >50 units $20/addtl. unit Improvement incentive: $200-$1,200 per unit based on improvement in building performance.	Improvement Incentive max: the lesser of $100,000 or 60% of the net construction costs of the energy efficiency measures.	Property must be served by both Southern California Edison and Southern California Gas Company. All existing multifamily properties (minimum of 5 attached dwelling units) are eligible, including both market rate and affordable housing.	Energy upgrades must be completed by November 30, 2014. Energy upgrades must result in achieving a minimum of 10% improvement over the baseline building conditions. Project must include at least three energy-efficiency measures to meet the performance measure. Project must work with an approved Rater.	EE	Not available.	The program provides free technical assistance to identify cost-effective upgrade measures. Is also offers incentives for comprehensive energy audits, and retrofit work.	https://multifamily.energyupgradeca.org/local#los_angeles	https://multifamily.energyupgradeca.org/#case_studies_tab
Energy Upgrade California Multi-family Program, Marin	Marin Energy Authority	Marin County, CA	Financing	No	Not available.	Not available.	5% interest on 5-10 year term. Loan charge placed on utility bill.	Must be Marin Clean Energy (MCE) customer. Open to multi-family and commercial accounts.	Scope of Work must be recommended through MCE Energy Efficiency Program. Must be a MCE customer. Credit is subject to lender's approval.	EE	Not available.	On-Bill Repayment Plan to help multi-family and commercial accounts finance energy efficiency upgrades.	https://multifamily.energyupgradeca.org/local#marin	Not available.

Appendix J. Measures Installed Through ESA 2010-2012

Methodology

The IOUs provided tracking data for multifamily (5+ units) participants in the ESA Program for the years 2010 to 2012, which included information about the number of measures installed. Table 36 shows the detailed category information provided by each utility, indicating the range of measures installed. The level of detail provided varies by utility.

Table 36. Measures Provided Through the ESA Program by Utility

Utility	Measure	Measure Subtype	Measure Category
PG&E	AC - Central		
PG&E	AC - Central - Assessment		
PG&E	AC - Central - Tune Up (<20%)		
PG&E	AC - Central - Tune Up (>=20%)		
PG&E	AC - Central - Tune Up (Test Only)		
PG&E	AC - Central - Tune Up (Trip Charge)		
PG&E	AC >10-15K BTU		
PG&E	AC >10-15K BTU CoPay		
PG&E	AC >15K BTU		
PG&E	AC >15K BTU CoPay		
PG&E	AC >6-10K BTU		
PG&E	AC >6-10K BTU CoPay		
PG&E	Attic Access Install		
PG&E	Attic Access Wthrstr		
PG&E	Attic Insulation		
PG&E	Attic Venting		
PG&E	C-10 Certificate		
PG&E	Caulking, MUD (flat fee)		
PG&E	Ceiling Repair		
PG&E	CFL		
PG&E	CFL$ - High		
PG&E	CFL$ - Low		
PG&E	CFL$ - Medium		
PG&E	Clothes Washing Machine		
PG&E	Cover Plates Repl		
PG&E	CVA		
PG&E	Direct Costs - MF		
PG&E	Direct Costs - Timely Completion		
PG&E	Door Jambs		
PG&E	Door Patch/Plate		
PG&E	Door Repl $'s (Mat.)		

Utility	Measure	Measure Subtype	Measure Category
PG&E	Door Replacement - Louvered		
PG&E	Doors Repl		
PG&E	Doors Wthrstrp		
PG&E	Duct Assessment - Electric		
PG&E	Duct Assessment - Gas		
PG&E	Duct Test - Electric		
PG&E	Duct Test - Gas		
PG&E	Energy Education - Leverage Adjustment		
PG&E	Energy Education - MUD		
PG&E	Evap Cooler Cover		
PG&E	Exhaust Fan Vent $'s		
PG&E	Exhaust Fan Vent Repair-Attic		
PG&E	Exhaust Fan Vent Repair-Dryer		
PG&E	Faucet Aerators - Electric		
PG&E	Faucet Aerators - Gas		
PG&E	Floor Repair		
PG&E	Foam Wall Patch		
PG&E	Furnace Repair - Gas		
PG&E	Furnace Replace - Gas		
PG&E	Furnace Venting (R&R)		
PG&E	Gas Surcharge - EEM		
PG&E	Gas Surcharge - Refrigerator		
PG&E	Glass Repl		
PG&E	Glazing Compound		
PG&E	Home Grounding Fee		
PG&E	Home Grounding Trip Charge		
PG&E	HWD Lights Exterior		
PG&E	HWD Lights Interior		
PG&E	Lock Set		
PG&E	Lock Set $'s (Mat.)		
PG&E	Marketing & Assessment		
PG&E	MHR Shop Fee		
PG&E	Microwave - Elect		
PG&E	Microwave - Gas		
PG&E	NGAT $		
PG&E	NGAT R&R		
PG&E	Obsolete HWD Light Interior		
PG&E	Occupancy Sensor		

Utility	Measure	Measure Subtype	Measure Category
PG&E	Pipe Insulation - Electric		
PG&E	Pipe Insulation - Gas		
PG&E	Refrigerator - Large		
PG&E	Refrigerator - Medium		
PG&E	Refrigerator - Medium CoPay		
PG&E	Refrigerator - Small		
PG&E	Refrigerator - Small CoPay		
PG&E	Refrigerator - X Large		
PG&E	Refrigerator - X Large CoPay		
PG&E	Refrigerator BFM - Large		
PG&E	Refrigerator SXS - Large		
PG&E	Service Call R&R		
PG&E	Showerheads - Electric		
PG&E	Showerheads - Gas		
PG&E	Specialty Glass $'s		
PG&E	Thermostatic Valve - Gas		
PG&E	Thermostatic Valve - Elec		
PG&E	Thresholds Installed		
PG&E	Torchiere		
PG&E	Utility Gaskets		
PG&E	Vent Alignment		
PG&E	Vent Material $ - AWH		
PG&E	Vent Material $ - Heater		
PG&E	Vent Repair - AWH		
PG&E	Vent Repair - Heater		
PG&E	Wall Repair - Exterior		
PG&E	Wall Repair - Interior		
PG&E	Water Heater (Repair) - Gas		
PG&E	Water Heater (Replacement) - Electric		
PG&E	Water Heater (Replacement) - Gas		
PG&E	Water Heater Blanket - Electric		
PG&E	Water Heater Blanket - Gas		
PG&E	Water Heater Venting (R&R)		
PG&E	Weed and Seed		
PG&E	Window Assembly Replace <12 Sq. Ft per window		
PG&E	Window Assembly Replace > 12 Sq. Ft. per window		
PG&E	Window Sash Repair		

Utility	Measure	Measure Subtype	Measure Category
SCE	Assessment		
SCE	Central AC		
SCE	Central Heat Pump		
SCE	CFL		
SCE	Duct Test and Seal		
SCE	Energy Education		
SCE	Enrollment		
SCE	Maintain Central A/C		
SCE	Maintain Evaporative Cooler		
SCE	Permit Fee		
SCE	Refrigerant		
SCE	Refrigerator		
SCE	Room Air Conditioner		
SCE	Thermostat		
SCE	Title 24 Fee		
SCE	Torchiere		
SCE	Trip Charge		
SCE	Weatherization		
SCG	A/C Cover (Window/Wall)	MF	Envelope & Air Sealing
SCG	Appliance Dr Foam Tape/VStrip	MF	Envelope & Air Sealing
SCG	Attic Barrier - R11		Attic Insulation
SCG	Casing including Caulking	Door	Envelope & Air Sealing
SCG	Caulking	Window	Envelope & Air Sealing
SCG	Caulking (maximum 100')	Wall-MF	Envelope & Air Sealing
SCG	Clothes Washer HE	Frigidaire FAFW3577K	HE Clothes Washer
SCG	CVA Repair	Waterheater-MF	Envelope & Air Sealing
SCG	CVA - Repair	Water Heater	Envelope & Air Sealing
SCG	Door - Hinges Locking Pin		Envelope & Air Sealing
SCG	Door - Jambs including Caulking		Envelope & Air Sealing
SCG	Door - Specialty	Other	Envelope & Air Sealing
SCG	Door - Stop including Caulking		Envelope & Air Sealing
SCG	Door - Striker Plate, Safety or Mag type		Envelope & Air Sealing
SCG	Door - Threshold		Envelope & Air Sealing
SCG	Door Deadbolt	MF	Envelope & Air Sealing
SCG	Door Lockset Brace	MF	Envelope & Air Sealing
SCG	Door Threshold	MF	Envelope & Air Sealing
SCG	Door-Handle		Envelope & Air Sealing
SCG	Dryer Vent	Only MF	Envelope & Air Sealing
SCG	Furnace Filter		Furnace Clean&Tune

Utility	Measure	Measure Subtype	Measure Category
SCG	Glass Replacement	Tempered	Envelope & Air Sealing
SCG	Low Flow Showerhead	Regular	WH Conservation
SCG	Seal FAU Base	MF	Envelope & Air Sealing
SCG	Window Glass Louvered	MF	Envelope & Air Sealing
SCG	Attic Access Cover		Envelope & Air Sealing
SCG	Attic Access New		Envelope & Air Sealing
SCG	Attic Insulation	R-19	Attic Insulation
SCG	CVA Repair	Furnace-MF	Envelope & Air Sealing
SCG	Door - Hinge Spring		Envelope & Air Sealing
SCG	Door - Hinges Loose Pin		Envelope & Air Sealing
SCG	Door - Lockset		Envelope & Air Sealing
SCG	Door - Lockset Brace		Envelope & Air Sealing
SCG	Door - Replacement	Solid Core	Envelope & Air Sealing
SCG	Door Handle	MF	Envelope & Air Sealing
SCG	Door Jambs and Caulking	MF	Envelope & Air Sealing
SCG	Door Lockset	MF	Envelope & Air Sealing
SCG	Door Repl	24-28-30-32-34-36 Solid Core HL MF	Envelope & Air Sealing
SCG	Door Repl	34-42 Solid Core MF	Envelope & Air Sealing
SCG	Door Repl	Louver MF	Envelope & Air Sealing
SCG	Door Striker Plate, Safety or Mag type	MF	Envelope & Air Sealing
SCG	Glass Repl	DS MF	Envelope & Air Sealing
SCG	Glass Repl	SS MF	Envelope & Air Sealing
SCG	Glass Replacement	Specialty	Envelope & Air Sealing
SCG	Glazing Compound Sash/Sash		Envelope & Air Sealing
SCG	Shower Adapter		WH Conservation
SCG	Shower Diverter		WH Conservation
SCG	Silicone Clking (crack/bb hole)	MF	Envelope & Air Sealing
SCG	Standing Pilot Retrofit	Hard Pipe-FAU	FAU StandPilot/ChangeOut
SCG	Switch/Outlet Gaskets & Cover	SF	Envelope & Air Sealing
SCG	Thermostatic Shower Valve		WH Conservation
SCG	Water Heater Pipe Insulation		WH Conservation
SCG	Weatherstripping	Appliance Closet (Foam Tape)	Envelope & Air Sealing
SCG	Weatherstrippng	Attic Access MF	Envelope & Air Sealing
SCG	Air Conditioner Cover (Window/Wall)		Envelope & Air Sealing
SCG	Appliance Dr Rigid Gasket	MF	Envelope & Air Sealing
SCG	Attic Insulation		Attic Insulation
SCG	Caulking (maximum 100')	Door-MF	Envelope & Air Sealing
SCG	Caulking (maximum 100')	Window-MF	Envelope & Air Sealing

Utility	Measure	Measure Subtype	Measure Category
SCG	Door - Deadbolt		Envelope & Air Sealing
SCG	Door - Double Door Slide Bolt		Envelope & Air Sealing
SCG	Door - Replacement	Solid Core - HL	Envelope & Air Sealing
SCG	Door - Shoe		Envelope & Air Sealing
SCG	Door Hinges Loose Pin	MF	Envelope & Air Sealing
SCG	Door Hinges Springs	MF	Envelope & Air Sealing
SCG	Door Repl	24-28-30-32-36 Solid Core MF	Envelope & Air Sealing
SCG	Door Shoe	MF	Envelope & Air Sealing
SCG	Door Striker Plate	MF	Envelope & Air Sealing
SCG	Door Sweep	MF	Envelope & Air Sealing
SCG	Dryer Venting	Vent Only	Envelope & Air Sealing
SCG	Faucet Aerator		WH Conservation
SCG	Faucet Aerator Adaptor		WH Conservation
SCG	Glass Replacement	DS Glass	Envelope & Air Sealing
SCG	Glzing Compound Sash/Sash	MF	Envelope & Air Sealing
SCG	Low Flow Showerhead	Hand Held	WH Conservation
SCG	Silicone Caulking (crack/bb hole)		Envelope & Air Sealing
SCG	Standing Pilot Retrofit	Line Valve	FAU StandPilot/ChangeOut
SCG	Switch/Outlet Gaskets & Cover	MF	Envelope & Air Sealing
SCG	Wall Rpr	Plaster MF	Envelope & Air Sealing
SCG	Wall Rpr	Stucco MF	Envelope & Air Sealing
SCG	Wall Rpr	UT Pen (foam tape) MF	Envelope & Air Sealing
SCG	Water Heater Blanket	Central	WH Conservation
SCG	Water Heater Blanket	Individual	WH Conservation
SCG	Weatherstripping	Door (Rigid Gasket)	Envelope & Air Sealing
SCG	Weatherstripping	Foam Tape V Strip	Envelope & Air Sealing
SCG	Weatherstrippng	Door (Rigid Gasket) MF	Envelope & Air Sealing
SCG	Weatherstrippng	Door (V-Strip) MF	Envelope & Air Sealing
SCG	Window Assembly	MF	Envelope & Air Sealing
SCG	Window Set Assembly		Envelope & Air Sealing
SCG	Attic Insulation	R-30	Attic Insulation
SCG	Casing and Caulking	Door-MF	Envelope & Air Sealing
SCG	Caulking	Door	Envelope & Air Sealing
SCG	Caulking	Walls	Envelope & Air Sealing
SCG	Door Stop and Caulking	MF	Envelope & Air Sealing
SCG	Door - Striker Plate		Envelope & Air Sealing
SCG	Door Hinges Lking Pin	MF	Envelope & Air Sealing
SCG	Evap Cooler Register Cover	MF	Envelope & Air Sealing
SCG	Evaporative Cooler Register Cover		Envelope & Air Sealing

Utility	Measure	Measure Subtype	Measure Category
SCG	FAU Closet Door Latch		Envelope & Air Sealing
SCG	FAU Closet Dr Latch	MF	Envelope & Air Sealing
SCG	Furnace Clean-Tune	MF	Furnace Clean&Tune
SCG	Glass Repl	Polycarbonte MF	Envelope & Air Sealing
SCG	Glass Repl	Tempered MF	Envelope & Air Sealing
SCG	Glass Replacement	Polycarbonate	Envelope & Air Sealing
SCG	Glass Replacement	SS Glass	Envelope & Air Sealing
SCG	Roof	Mastic	Envelope & Air Sealing
SCG	Roof Mastic	MF	Envelope & Air Sealing
SCG	Seal FAU Platform		Furnaces
SCG	Standing Pilot Retrofit	Flex Connector	FAU StandPilot/ChangeOut
SCG	Standing Pilot Retrofit	Kit	FAU StandPilot/ChangeOut
SCG	Vents	Dormer	Envelope & Air Sealing
SCG	Wall Repair	Plaster - Interior	Envelope & Air Sealing
SCG	Wall Repair	Stucco - Exterior	Envelope & Air Sealing
SCG	Wall Repair	UT Pen (Foam/Tape)	Envelope & Air Sealing
SCG	Weatherstripping	Attic Access	Envelope & Air Sealing
SDG&E	Air Sealing		
SDG&E	Attic Insulation		
SDG&E	Compact Fluorescent Lights (CFLs)		
SDG&E	Duct Testing and Sealing		
SDG&E	Exterior Hard wired CFL fixtures		
SDG&E	FAU Standing Pilot Light Conversion		
SDG&E	Faucet Aerator		
SDG&E	Furnace Repair/Replacement		
SDG&E	In-Home Education		
SDG&E	Interior Hard wired CFL fixtures		
SDG&E	LED Night Lights		
SDG&E	Low Flow Showerhead		
SDG&E	Microwaves		
SDG&E	NGAT		
SDG&E	Outreach & Assessment		
SDG&E	Refrigerators		
SDG&E	Room A/C Replacement		
SDG&E	Thermostatic Shower Valve		
SDG&E	Torchiere		
SDG&E	Water Heater Blanket		
SDG&E	Water Heater Pipe Insulation		
SDG&E	Water Heater Repair/Replacement		

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Appendix L. ESA Program Interview Guides and Survey

Property Owner and Manager Interview Guide

Introduction

Hello, my name is [INTERVIEWER NAME] from Cadmus and I'm calling on behalf of the California Public Utility Commission and the utilities. We are conducting a statewide study that will guide California's energy efficiency services for multifamily property owners and managers.

I would like to ask you a few questions that will help with this study. Do you have about 15 minutes now, or could I schedule another time this week that works better for you?

Study overview

The objective of the research is to characterize the low-income multifamily market segment and use the information to investigate strategies the utilities could use to serve these customers through the Energy Savings Assistance (ESA) Program. The commission's vision is to provide cost-effective measures to 100% of eligible and willing customers by 2020. The research will inform our recommendations that enhance program design and delivery to meet the 2020 targets.

PROPERTY CHARACTERISTICS [Ask only if we are unable to get this information through web research. Try to get number of properties and number of units for a. and b. If they don't have numbers, ask for "what proportion"]

1. First, I would like to get information about your properties in general.

Properties by Size

Size of Properties	No. of Properties	No. of Units	Percentage of Properties (ONLY if numbers are not available)	Percentage of Units (ONLY if numbers are not available)
Small (25 or fewer units)				
Medium (26-249 units)				
Large (250 or more units)				

Properties by Category

Category of Properties	No. of Properties	Percentage of Properties (ONLY if numbers are not available)
Subsidized housing		
Market rate housing		
Market rate housing that includes low-income tenants		

a. Are there any differences in the way you manage market rate properties and affordable or subsidized properties?

DECISIONS ON ENERGY EFFICIENCY UPGRADES

Now we'd like to talk with you about how your company makes decisions about improvements or upgrades to any of your properties. We are talking about improvements such as installing a central heating or cooling system not landscaping.

2. When your company makes decisions about improvements or purchasing new equipment for any of your properties, who makes these decisions? We are looking for titles or positions, not names.

3. How does your company's decision making process change if you are making fairly major improvements to a new building versus making major improvements to an older building?

4. When your company decides to spend money on making fairly major improvements like installing a heating or cooling system do you plan for it or decide when it breaks?

5. How far in advance do you plan for something like a new heating or cooling system?
   a. (Less than 1 year before the project begins)
   b. (1 year to 2 years)
   c. (3 years to 4 years)
   d. (5 years or more)

DECISION DRIVERS

6. When you replace or update old or broken equipment, what factors influence your decision to select the equipment you install?
   a. (Energy efficiency)-- top
   b. (Cost/cost savings)—cost isn't that much different, most stores
   c. (Availability of equipment)
   d. (Size of upgrades/improvements)

7. Do any of these factors make it difficult to make energy efficiency upgrades?
   a. Lack of capital
   b. Lack of access to financing
   c. Lack of attractive financing terms
   d. Coordinating funding with opportunities to make upgrades or improvements

PAYING FOR PROPERTY IMPROVEMENTS

8. Do property owners or tenants typically pay the cost of improvements that may be made to units for things like lighting, room air conditioners, or appliances?

9. Within the individual units, what if any, appliances do tenants own?
   a. (Refrigerators)
   b. (Clothes washers)
   c. (Room/window AC units)
   d. (Small appliances such as toaster ovens or microwaves, etc.)

UTILITY REBATE PROGRAMS

10. Do you know if your company has taken advantage of any rebate programs offered by your gas or electric utility to help any of your properties be more energy efficient?
   a. Can you tell me the program names or a description of the programs?
   b. If not, do you know why not?

11. What could utilities and other agencies do to encourage your company to participate in rebate programs or to use financing options offered to assist property owners in making energy efficient upgrades to their properties? [DO NOT READ LIST. RECORD ALL THAT APPLY.]
   a. (Provide more information about the programs)
   b. (Simplify the information)
   c. (Provide upgrades at no cost)
   d. (Higher incentives/more money for rebate)
   e. (Allow us to choose our own contractor to do the work)
   f. (Provide on-bill financing)

ESA PROGRAM PARTICIPATION

12. Have you ever heard of a program offered by the utilities which provides income qualified households with free equipment and services such as energy efficient lighting or appliances to help customers save energy and money on their energy bills? [This is also known as the Energy Savings Assistance Program]

13. Do you know if any of your tenants at this location have taken advantage of this program?

14. This program requires you as property owners and managers to complete paperwork and allow contractors not hired by your company access to your property to make changes. How does your company handle this process?

FINANCING

15. We have some questions about financing and how multifamily property owners pay for large capital improvements. Is financing something you know about?
   a. No: skip to Question 6

b. If Yes to Question 2, ask:

16. How do you pay for large capital improvements to your properties?

a. Do you usually layer multiple sources of funding (such as rebates, tax credits, loans, cash) or use just one source?

17. Are there certain financial solutions only available in certain locations or situations? *(grants, loans, tax incentives)*

a. Please explain

18. Where do you see the main gaps in helping owners pay for energy-saving improvements to their properties?

Research Topics

[This question offers the participant an opportunity to identify particular areas of interest.]

19. Are there topics or issues you think are important to include in this this research in general?

We appreciate your time and contribution to this study. During the course of the analysis, we may come up with follow-up questions for you. Is it okay to call/email you with follow up questions, if we have them? Y/N and record any preferences/notes

Stakeholder Interview Guide

Introduction

Hello my name is _____ calling from The Cadmus Group. We are conducting a study for the California PUC and the utilities that focuses on the low income multifamily market segment. I'm calling community stakeholders working with this market to ask a few questions that will help with this study. Do you have about 15 minutes now, or could I schedule another time this week that works better for you? *(Interviewer: or next week if needed)*

Study overview

The objective of the Multifamily Segment Study is to characterize the low income market segment and use the information to investigate strategies the utilities could use to serve these customers through the Energy Savings Assistance (ESA) Program. The commission's vision is to provide cost-effective measures to 100% of eligible and willing customers by 2020. The research will inform our recommendations that enhance program design and delivery to meet the 2020 targets.

Do not read next section in italics; use only as reference if needed

The primary activities in this Study are designed to meet the CPUC ALJ Decision's (D.12-08-044) research objectives. These activities and areas of focus are:

- *Gather California Multifamily Housing Data Relevant for Low income Customer Programs (ongoing; analyze census data, HUD data, AHS data, IOU data etc)*
- *Catalog Existing Multifamily Energy Efficiency Programs Relevant for Low Income Customers (cataloged 41 programs in 28 states on 77 different data points covering the following major areas*
    a. *Program context*
    b. *Cost and cost effectiveness*
    c. *Eligible measures*
    d. *Implementation approaches)*
- *Review and Evaluate Multifamily Programs and Research Relevant for Low Income Customers (identified top 3 states from prior catalog – NY (NYSERDA), MA, CO)*

Low-Income Multifamily Weatherization	Energy Outreach Colorado	CO
Low Income Multifamily Retrofit program	MA Gas & Electric IOUs & Dept. of Housing and Community Development	MA
Multifamily Performance Program (MPP)	NYSERDA	NY

- *Identify and Assess Alternative Program Designs and Delivery Strategies (conducting background research)*
- *Identify Financing and Funding Options (ongoing)*

- *Conduct Public Workshops (first in March, next in Dec after draft report reviewed by Study Team)*

Constituency

[This section asks about the people represented by the stakeholder group. We will use this information to ensure we have reached all applicable populations.]

[INSTRUCTIONS FOR INTERVIEWER: research attendance at workshop and set up your contact list accordingly. If they did not attend the workshop, do not read this phrase in italics in question 1]

1. *We see that you attended the public workshop held in March. We appreciate your interest and* we would like to talk about the constituency your organization represents.
    a. Can you tell me about your constituency? (What groups/constituents do you represent?)
    b. How would you characterize your clients? (Affordable rent/market rate, large/small, etc.)

2. We are conducting a survey with about 300 MF property owners and managers. We are gathering information that will be used to make recommendations for ESA program enhancements. The survey asks about the multifamily buildings, ownership structures, the energy related needs of the tenants, and decision making processes purchasing energy efficient equipment. We want to be sure we include both market rate housing and subsidized housing. We compiled our sample from publicly available lists of subsidized housing. We also used the utility data to identify multifamily buildings that are likely to be market rate.

[INTERVIEWER: FOR YOUR REFERENCE, ADD THE LIST OF SUBSIDIZED HOUSING USED TO COMPILE CALL LISTS]

    a) What other groups *[landlord associations, property management companies, advocacy groups]* should we reach out to for connecting with property managers and owners that are not represented in the HUD or utility data sources? [*Probe: get the most complete information as possible]*
    b) [*If the current call list is missing their constituency, ask]* do you have a database with contact information that you could share with us?

3. The commission and utilities would like us to include apartments or condominiums that are owned by low income residents.
    a) Does your constituency fit this description?
    b) Do you have an information source or reference that can help us identify low-income condo or apartment owners? *[Probe: Try to get the most complete information as possible.]*
    c) Do you know of other advocacy groups that might represent this population*? [If yes, ask for organization name and contact information]*

Research Topics

[This question offers the stakeholder an opportunity to identify particular areas of interest.]

4. Are there topics or issues you think are important to include in this survey or in this research in general?

Financing

[This section collects information about financing options and potential financial barriers experienced by their constituents. Data will inform our recommendations about possible program strategies to reach the target market.]

5. We have some questions about financing and how multifamily property owners pay for large capital improvements. Is financing something you know about?
   a) No: skip to Question 10

If Yes to Question 5, ask

6. How do multifamily property owners pay for large capital improvements?
   a) Do they usually layer multiple sources of funding (such as grants, tax credits, financing, cash) or use just one source?

7. What types of financial solutions are available statewide to all your clients or constituency? (tax credits, grants, loans, etc.

8. Are there certain financial solutions only available to certain types of owners? *(grants, loans, tax incentives)*
   a) Or only in certain locations or situations? Please explain.

9. Where do you see the main gaps in helping owners pay for energy-saving improvements to their properties?

Other Stakeholders and Information Sources

[This section provides another opportunity for the stakeholder to provide input to the study and to reach the target market.]

10. Are there other stakeholders you recommend that we talk to?

11. Are there information sources about low income multifamily buildings that we should explore? *: get the most complete contact information as possible.]*

We appreciate your time and contribution to this study. During the course of the analysis, we may come up with follow-up questions for you. Is it okay to call/email you with follow up questions, if we have them? Y/N and record any preferences/notes

Building Owner and Manager Survey Script

Audience: This survey is for property owners and managers of low income multifamily properties in California.

Researchable Questions		Item
What are the characteristics of the low-income multifamily properties?	Building location, building age, number of units at property, buildings per complex, floors per building, size of apartment	**Error! Reference source not found.**- **Error! Reference source not found.**, **Error! Reference source not found.**, **Error! Reference source not found.**, **Error! Reference source not found.**- **Error! Reference source not found.**
	Total number of low income multifamily units managed by company	**Error! Reference source not found.**, **Error! Reference source not found.**
	System type, fuel type, and age of heating, cooling, and water heating equipment in units	**Error! Reference source not found.**- **Error! Reference source not found.**
	System type, fuel type and age of heating, cooling, and water heating equipment in common areas	**Error! Reference source not found.**- **Error! Reference source not found.**
	Type of property	**Error! Reference source not found.**
	Bedroom characteristics	**Error! Reference source not found.**- **Error! Reference source not found.**

Researchable Questions		Item
	Appliances in units	8
	Ownership and management structure	**Error! Reference source not found.**-**Error! Reference source not found.**
	Decision making structure	**Error! Reference source not found.**-4
	Improvements financing	**Error! Reference source not found.**-7
	Number of units managed in this property, How long they have owned or managed this property	**Error! Reference source not found.**, **Error! Reference source not found.**
	Relationship of respondent to property	**Error! Reference source not found.**
	Who pays for utilities?	**Error! Reference source not found.**-**Error! Reference source not found.**, **Error! Reference source not found.**
	Per-unit rent, rent subsidization, deed-restriction, or affordable housing structure,	**Error! Reference source not found.**, **Error! Reference source not found.**-**Error! Reference source not found.**
	Percentage of low income units in CA	**Error! Reference source not found.**,**Error! Reference source not found.**

Researchable Questions		Item
	Socioeconomic characteristics of tenant	**Error! Reference source not found.**-**Error! Reference source not found.**
	Amount of rent and fees	**Error! Reference source not found.**-**Error! Reference source not found.**
	What equipment is upgraded, who made the decisions, was it upgraded with standard or high efficiency equipment, and who pays for it?	**Error! Reference source not found.**, **Error! Reference source not found.**-8
	Tenant participation in ESA	**Error! Reference source not found.**-**Error! Reference source not found.**
	Reasons for energy efficiency upgrades in properties and units?	**Error! Reference source not found.**
Energy efficiency upgrades	Benefits for making energy efficiency upgrades in common areas	**Error! Reference source not found.**-**Error! Reference source not found.**
	Property owner programs	**Error! Reference source not found.**
Program Awareness	Tenant programs	**Error! Reference source not found.**-**Error! Reference source not found.**
	Property owner programs (MFEER and others)	**Error! Reference source not found.**-**Error! Reference source not found.**
Program Participation	Tenant programs (ESAP) and owner	**Error! Reference**

Researchable Questions		Item
	programs	**source not found.**, **Error! Reference source not found.**
	Barriers to energy efficiency	**Error! Reference source not found.**, **Error! Reference source not found.**, 14
What do the multifamily properties need to improve energy efficiency?	Ways to increase participation among property owners	11
What will enhance the ESA program and delivery structure so the program can serve more tenants?	Additional equipment needed in programs	
What are the gaps in equipment and the program?	Respondent perspectives about tenant and building needs	

Response options in ( ) are not read.

Items in boxes are not to be read.

Interviewer instructions are in green.
CATI programming instructions are in red.

[Variables from sample]
[ADDRESS] – Original address from sample
[UTILITY]

*MFEEER Survey questions are identified by the leading asterisk

Survey Quotas

The survey includes screening questions that will be used to develop quotas described in the sampling plan. We will complete surveys for each of three size strata until we have reached a quota of 50, for a total of 150 completes across the three size strata for (1) assisted housing, and (2) market rate housing. We will define the size strata to capture the smallest 45% of companies, the middle 45% of companies relative to size, and the largest 10% of companies. Based on research conducted for the MFEER process evaluation, and subject to additional refinement, these three categories represent companies (1) managing no more than 25 units; (2) more than 25 but no more than 250 units; and, (3) 250 units or more.

Sample List	Size	Target	Definition
Assisted Housing (based on sample)	1. Small	50	**Error! Reference source not found.**+**Error! Reference source not found.**=25 or fewer units
	2. Medium	50	**Error! Reference source not found.**+**Error! Reference source not found.**=26-249 units
	3. Large	50	**Error! Reference source not found.**+**Error! Reference source not found.**=250+ units
Subtotal		**150**	
Market Rate (based on sample)	4. Small	50	**Error! Reference source not found.**+**Error! Reference source not found.**=25 or fewer units
	5. Medium	50	**Error! Reference source not found.**+**Error! Reference source not found.**=26-249 units
	6. Large	50	**Error! Reference source not found.**+**Error! Reference source not found.**=250+ units
Subtotal		**150**	
TOTAL		300	

A. Introduction/Screening

A1. Hello, my name is [INTERVIEWER NAME] from [FIRM] and I'm calling on behalf of [UTILITY], your local electric utility. [UTILITY] is conducting an important statewide study that will guide the energy efficiency services they offer in the multifamily rental market. May I speak with the person who makes decisions about building and equipment upgrades to the property and rental units at [ADDRESS]?

1. (Yes, speaking to the decision maker)
2. (Yes, call transferred to someone else [READ INTRO AGAIN])
3. (Yes, but at a different number [CALL NEW NUMBER AND BEGIN AGAIN])

99. (Refused) [THANK AND TERMINATE]

Back-up information, not to be programmed:
[If "No – Not a convenient time," ask if would like to arrange a more convenient time for us to call them
back or if you can leave a message for that person.]

[IF RESPONDENT ASKS HOW LONG, SAY: "Approximately 20 minutes."]
[IF NEEDED:] This statewide study will guide the design of California's energy efficiency services for multifamily owners and property managers. We would appreciate your help today and would like to talk with you about your company's rental properties. Your participation is important to our research and because of this we will email a copy of the report to all qualified survey participants once it is available
to the public.

[**Only if asked** for a contact to verify the survey authenticity, offer Mary O-Drain 415.973.2317 or Tori Francisco 415.703.2743]

A2. About how many units are there on the [ADDRESS OR C_ADDRESS] property? [IF DON'T KNOW ASK FOR BEST GUESS]

1. [ENTER ANSWER_____] [RANGE: 1-99999]
98. (Don't know) [ASK TO SPEAK WITH SOMEONE ELSE AND BEGIN AGAIN.]
99. (Refused) [THANK AND TERMINATE]

A3. How many buildings are at [ADDRESS or C_ADDRESS]? [IF DON'T KNOW ASK FOR BEST GUESS]

1. [ENTER ANSWER_____] [RANGE: 1-9999]
98. (Don't know)
99. (Refused) [THANK AND TERMINATE]

A4. Are there at least five units in one of the buildings? [IF DON'T KNOW ASK FOR BEST GUESS]

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused) [THANK AND TERMINATE]

[ASK IF A4= NO OR DON'T KNOW]

A5. Do you have another California property with 5 or more units serving low income tenants?

1. (Yes) [GO BACK TO A2 AND ENTER THIS ADDRESS (C_AADDRESS) IN AND PROCEED WITH STUDY.]
2. (No) [THANK AND TERMINATE]
98. (Don't know) [THANK AND TERMINATE]
99. (Refused) [THANK AND TERMINATE]

[TERMINATE SCRIPT]

Thank you for your time today. We are interested in talking with owners and managers of multifamily buildings with 5 or more units that house low income tenants. It seems that your company does not fit this description. Have a good day.

THE NEXT QUESTIONS PROVIDE DATA TO HELP CHARACTERIZE LOW INCOME MULTIFAMILY HOUSING IN CA. THESE QUESTIONS ARE ALSO USED (A6) TO BIN RESPONDENTS BY SIZE FOR THE SAMPLE STRATA. ONCE THE STRATA ARE FILLED, WE WILL THANK AND TERMINATE

A6. In addition to the [INSERT ANSWER FROM A2] units you mentioned, roughly how many **additional** units would you say that your company owns or manages in the rest of its properties in California?

1. [ENTER ANSWER_____] [RANGE: 1-9999]
98. (Don't know)
99. (Refused)

[ASK IF A6=98 OR 99]

A7. Are there … [READ LIST] [ASK FOR BEST GUESS]

1. 4 or fewer units
2. 5 to 25 units
3. 26 to 249 units
4. 250 or more units
98. (Don't know)
99. (Refused)

[BUCKET THESE AS DON'T KNOW/REFUSE UNIT SIZE AND SEND THE DETAILS OF THESE EACH DAY AND WE WILL DETERMINE WHICH QUOTA TO PLACE THEM IN.]

A8. *Is the [ADDRESS OR C_ADDRESS] property a rental property where the tenants pay rent, or is the property a condominium, where the tenants own their units?

1. Rental property [CONTINUE]
2. Condominium [CONTINUE]
3. (Neither) [CONTINUE]
98. (Don't know) [CONTINUE]
99. (Refused) [CONTINUE]

B. Ownership

THESE QUESTIONS WILL HELP IDENTIFY THE OWNERSHIP STRUCTURE AND RESPONDENT RESPONSIBILITY AT THE SELECTED PROPERTY.

READ: Now I'd like to know a little more about you and your company.

B1. *Does your company own, manage, or both own and manage the property? [RECORD SINGLE RESPONSE]

1. (Owns only – does not manage)
2. (Manages only – does not own)
3. (Owns and manages properties)
4. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

B2. Is the property owned by an individual, a corporation, or something else? [RECORD SINGLE RESPONSE; READ LIST IF NECESSARY]

1. (Individual)
2. (Corporation or partnership, LLC, limited partnership)
3. (Private institution)
4. (Non-profit institution)
5. (Public institution)
6. (Or something else) [SPECIFY:_____]
98. (Don't know)
99. (Refused)

B3. *How long has your company managed or owned this property? [RECORD MONTHS IF RESPOND IN MONTHS] [RANGE 1-99] [RECORD YEARS IF RESPOND IN YEARS] [RANGE 0-99]

B4. *What is the best way to describe your role at your company? Are you the. . .? **[READ LIST]**

1. Property owner
2. Property manager
3. Both property owner and manager
4. Maintenance or facilities supervisor
5. Or something else [PLEASE SPECIFY:_____]

98. (Don't know)
99. (Refused)

C. Utilities

READ: Now we'd like to talk about the heating and cooling systems at [ADDRESS OR C_ADDRESS**].**

THESE QUESTIONS IDENTIFY THE HEATING SYSTEM, FUEL TYPE, AND AGE OF SYSTEM.

C1. Are the units heated by a central system or individual systems?

1. (Central system)
2. (Individual systems)
3. (Other [SPECIFY:_____])
4. (No heat)

98. (Don't know)
99. (Refused)

C2. *What is the primary fuel used to heat the units at this address? [READ LIST IF NECESSARY]

1. (Electricity)
2. (Gas)
3. (Other [SPECIFY:_____])

98. (Don't know)
99. (Refused)

C3. What is the primary type of heating system used in the units? [READ LIST –PROMPT--IF NECESSARY]

1. (Boiler)
2. (Gas or electric wall unit)
3. (Furnace)
4. (Heat pump)
5. (Rooftop unit)
6. (Other [SPECIFY:_____])

98. (Don't know)
99. (Refused)

C4. Has the heating system been replaced or is it original with the building?

1. (Replaced)
2. (Original)
98. (Don't know)
99. (Refused)

THESE QUESTIONS IDENTIFY THE COOLING SYSTEM, FUEL TYPE, AND AGE OF SYSTEM.

C5. Does the building use central cooling, room or window air conditioners, or have no air conditioning?
1. (Central)
2. (Room/window) [SKIP TO C7]
3. (No AC) [SKIP TO C8]
98. (Don't know) [SKIP TO C8]
99. (Refused) [SKIP TO C8]

[ASK IF C5 = 1]
C6. Has the central cooling system been replaced or is it original with the building?
1. (Replaced)
2. (Original)
98. (Don't know)
99. (Refused)

[ASK IF C5 = 2]
C7. When you replace window or room air conditioners, do you replace them all at once or as they break or need repairs?
1. (All at once)
2. (When they break)
98. (Don't know)
99. (Refused)

THESE QUESTIONS IDENTIFY WHETHER THEY USE A CENTRAL WATER HEATING SYSTEM, THE FUEL TYPE, AND AGE OF SYSTEM.

C8. Does the building use a central water heating system or are there individual water heaters for each unit?
1. (Central water heating system)
2. (Individual water heaters for each unit)
3. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

C9. What is the primary fuel used to heat water in the individual units or the central water heating system? [READ LIST IF NECESSARY]
1. (Electricity)
2. (Natural gas)

3. (Propane)
4. (Solar)
5. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

C10. Has the water heating system been replaced or is it original with the building?
1. (Replaced)
2. (Original)
98. (Don't know)
99. (Refused)

READ: Now I'd like to talk about how the common areas are heated and cooled for the location we have been talking about. By common areas, we are referring to hallways, laundry rooms, or other areas that are open to all tenants.

THESE QUESTIONS IDENTIFY WHETHER THEY HAVE COMMON AREAS AND WHETHER THE COOLING AND/OR HEATING SYSTEMS ARE THE SAME AS THOSE USED IN THE UNITS.

C11. Does this property have common areas such as laundry rooms, hallways, or other areas that are open to all tenants?
1. (Yes)
2. (No) [SKIP TO D1]
98. (Don't know) [SKIP TO D1]
99. (Refused) [SKIP TO D1]

C12. Are the common areas **heated** the same way as the units?
1. (Yes)
2. (No)
3. (No heating)
98. (Don't know)
99. (Refused)

C13. Are the common areas **cooled** in the same way as the units?
1. (Yes)
2. (No)
3. (No cooling)
98. (Don't know)
99. (Refused)

THESE QUESTIONS IDENTIFY THE TYPE OF HEATING SYSTEM, FUEL TYPE, AND AGE OF HEATING SYSTEM USED IN THE COMMON AREAS

[ASK IF C12= NO]

C14. What type of system is used to heat the **common areas** at this location? [IF NEEDED: Common areas include hallways, laundry areas, and other areas open to all tenants. READ LIST ONLY IF NECESSARY]

1. (No heating system) [SKIP TO INSTRUCTION BEFORE C17]
2. (Boiler)
3. (Furnace)
4. (Heat pump)
5. (Rooftop unit)
6. (Other [SPECIFY:_____])

98. (Don't know)
99. (Refused)

[ASK IF C12 = NO]

C15. What is the primary fuel used to heat the common areas at this location? [READ LIST IF NECESSARY]

1. (Electricity)
2. (Gas)
3. (Other [SPECIFY:_____])

98. (Don't know)
99. (Refused)

[ASK IF C12= NO]

C16. Has the heating system in the common areas been replaced or is it original with the building?

1. (Replaced)
2. (Original)

98. (Don't know)
99. (Refused)

THE NEXT QUESTIONS ARE ABOUT THE COOLING SYSTEM USED IN THE COMMON AREAS AND ITS AGE.

[ASK IF C13 = NO]

C17. What type of system cools the **common areas** at this location? [MARK ALL THAT APPY. READ LIST IF NECESSARY]

1. (No cooling system) [SKIP TO D1]
2. (Central A/C)
3. (Room A/C or window units)
4. (Swamp cooler)
5. (Evaporative cooler)
6. (Ceiling fans)
7. (Stand- alone fans)
8. (Other [SPECIFY:_____])

98. (Don't know)
99. (Refused)

[ASK IF C13= NO]

C18. Has the central cooling system been replaced or is it original with the building?

1. (Replaced)
2. (Original)
98. (Don't know)
98. (Refused)

D. Decision Making

THESE QUESTIONS IDENTIFY WHO MAKES DECISIONS REGARDING ENERGY EFFICIENCY UPGRADES.

Now we'd like to talk with you about how your company makes decisions about improvements or upgrades to any of your properties, not just the one we've been discussing. We are talking about improvements such as installing a central heating or cooling system not landscaping.

D1. When your company makes decisions about improvements or purchasing new equipment for any of your properties, who makes these decisions? We are looking for titles or positions, not names. [ALLOW MULTIPLE RESPONSES; IF MULTIPLE PEOPLE FIND OUT WHO MAKES THE FINAL DECISION]

1. [SPECIFY:_____]
98. (Don't know)
99. (Refused)

THESE QUESTIONS WILL TELL US WHETHER THEY ONLY UPGRADE SYSTEMS WHEN THEY BREAK OR IF THEY PLAN AHEAD FOR IMPROVEMENTS OR UPGRADES AND HOW FAR IN ADVANCE THEY PLAN FOR THESE TYPES OF IMPROVEMENTS.

D2. How does your company's decision making process change if you are making fairly major improvements to a new building versus making major improvements to an older building?

1. [RECORD ANSWER]
2. (Our decision making process doesn't change)
98. (Don't know)
99. (Refused)

D3. Does your company usually make decisions one building at a time, or for the whole portfolio at the same time?

1. (The whole portfolio)
2. (Each building)
3. (It depends [SPECIFY:_____])
98. (Don't know)
99. (Refused)

D4. When your company decides to spend money on making fairly major improvements like installing a heating or cooling system do you plan for it or decide when it breaks? [RECORD ONE ANSWER]

1. (Plan for it)
2. (When it breaks)
3. (Both)

98. (Don't know)
99. (Refused)

[ASK IF D4=1 or 3]

D5. How far in advance do you plan for something like a new heating or cooling system? [READ LIST IF NEEDED]

1. (Less than 1 year before the project begins)
2. (1 year to 2 years)
3. (3 years to 4 years)
4. (5 years or more)
5. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

THE NEXT QUESTIONS FOCUS ON HOW THE COMPANY PAYS FOR BROKEN OR REPLACEMENT EQUIPMENT.

D6. When equipment like heating systems or water heaters are broken and can't be repaired, does your company take out a loan, charge the expenses, or use savings for the replacements? [RECORD ALL THAT APPLY; READ LIST IF NEEDED]

1. (Take out a new loan)
2. (Credit Card)
3. (Savings)
4. (Reserve account)
5. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

D7. How about if you are replacing or upgrading old equipment that may still work? Does your company take out a loan, charge the expenses, or use savings for the replacements? [RECORD ALL THAT APPLY; READ LIST IF NEEDED]

1. (Take out a new loan)
2. (Credit Card)
3. (Savings)
4. (Reserve account)
5. (Other [SPECIFY:_____])
6. (Never do this)
98. (Don't know)
99. (Refused)

THIS QUESTION ASKS ABOUT FINANCTING OPTIONS FOR IMPROVEMENTS.

D8. Are you aware of any financing options that may assist you with these expenses?

1. (Yes) [ASK: What options are you aware of?] [DON'T READ LIST; RECORD ALL THAT APPLY]
    1. (Tax credits)

2. (Loans)
3. (Grants)
4. (On-bill payment)
5. (Utility rebates/incentives)
6. (Other [SPECIFY:__]

2. (No)
98. (Don't know)
99. (Refused)

THIS QUESTION TELLS US THE DECISION DRIVERS.

[ASK EVERYONE]

D9. When you replace or update old or broken equipment, what factors influence your decision to select the equipment you install? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (Energy efficiency)
2. (Cost/cost savings)
3. (Availability of equipment)
4. (Size of upgrades/improvements)
5. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

D10. Do any of these factors make it difficult to make energy efficiency upgrades? [READ EACH AND GET A YES OR NO FOR EACH. RECORD 1 FOR YES, 2 FOR NO, 98 FOR DON'T KNOW, AND 99 FOR REFUSED]

1. Lack of capital
2. Lack of access to financing
3. Lack of attractive financing terms
4. Coordinating funding with opportunities to make upgrades or improvements

E. Equipment Replacement & Maintenance

READ: Now we want to ask about past energy savings activities your company may have taken. We would like you to answer these questions for [ADDRESS OR C_ADDRESS] we've been discussing.

THIS SET OF QUESTIONS WILL DETERMINE WHAT EQUIPMENT HAS BEEN REPLACED RECENTLY, WHY IT WAS REPLACED, WHO DECIDED TO REPLACE IT, WHETHER IT WAS REPLACED WITH ENERGY EFFICIENT EQUIPMENT AND WHY IT WASN'T REPLACED WITH EE EQUIPMENT.

E1. *For each of the following types of equipment, has your company replaced the equipment in the past couple of years? Let's start with…[RECORD 1 FOR YES, 2 FOR NO, 96 FOR LEASE EQUIPMENT,
97 FOR NOT APPLICABLE, 98 FOR DON'T KNOW, 99 FOR REFUSED] [INTERVIEWER NOTE: IF THEY LEASE THEIR CLOTHES WASHERS OR DRYERS CODE AS 96 FOR LEASE EQUIPMENT]

E1a. Lighting in hallways or parking lots

E1b. Air conditioning system
E1c. Heating system
E1d. Clothes washers or dryers in shared laundry rooms [IF LEASE, CODE AS 96]
E1e. Appliances in tenant units
E1f. Lighting in tenant units
E1g. Swimming pool pumps

[ASK E1-E4 FOR EACH YES RESPONSE IN E1 BEFORE MOVING TO THE NEXT "YES" RESPONSE] E2.Why was [INSERT YES ANSWER FROM E1] replaced? [READ LIST IF NECESSARY]

1. (It was broken or failed)
2. (It was old but not broken)
3. (Upgraded/renovated)
4. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

E3. Who decided to replace the [INSERT YES ANSWER FROM E1]? [READ LIST IF NECESSARY; RECORD ALL THAT APPLY]

1. (Property owner)
2. (Property manager)
3. (Maintenance manager)
4. (Other [SPECIFY:_____])
5. (Tenant)
98. (Don't know)
99. (Refused)

E4. Was the [INSERT YES ANSWER FROM E1] replaced with standard energy efficiency or high energy efficiency equipment?

1. (Standard efficiency)
2. (High efficiency)
98. (Don't know)
99. (Refused)

[ASK IF ANY "STANDARD EFFICIENCY" RESPONSE IN E4]

E5. For the equipment your company did not replace with more energy efficient equipment, can you tell me why your company did not make those improvements with more energy efficient equipment? [PROBE FOR MULTIPLE RESPONSES AND GET CLEAR DETAILS]

1. [RECORD ANSWER:_____]
98. (Don't know)
99. (Refused)

READ: Let's talk about who pays for replacement equipment in individual units.

THIS QUESTION INDICATES WHO PAYS FOR IMPROVEMENTS.

E6. Do property owners or tenants typically pay the cost of improvements that may be made to units for things like lighting, room air conditioners, or appliances?

1. (Property owners)
2. (Tenants)
3. (Both, or It depends)

E9a. [SPECIFY: Who pays for what?_____]

98. (Don't know)
99. (Refused)

THESE QUESTIONS ARE ABOUT WHO OWNS APPLIANCES AND WHERE THE APPLIANCES ARE PURCHASED.

E7. Within the individual units, what if any, appliances do tenants own? [RECORD ALL THAT APPLY; DON'T READ LIST UNLESS NECESSARY]

1. (Refrigerators)
2. (Clothes washers)
3. (Room/window AC units)
4. (Small appliances such as toaster ovens or microwaves, etc.)
5. (Other [SPECIFY:_____])
6. (None)

98. (Don't know)
98. (Refused)

F. Awareness

READ: Now I'd like to find out more about your experiences with energy efficiency programs.

THESE QUESTIONS WILL TELL US ABOUT WHETHER THEY HAVE USED UTILITY REBATE PROGRAMS AND IF THEY HAVEN'T WHY NOT.

F1. Do you know if your company has taken advantage of any rebate programs offered by your gas or electric utility to help any of your properties be more energy efficient? [IF NEEDED: This would include rebate programs to install high efficiency appliances, install high efficiency heating or cooling systems, or install energy efficient lighting.]

1. (Yes)
2. (No)

98. (Don't know)
99. (Refused)

[ASK IF F1=1]

F2. Please provide the program names if you know them or a brief description of the program. [PROBE FOR MULTIPLE ANSWERS AND CLARIFY PROGRAM DETAILS, NAMES OF PROGRAMS,

AND WHO SPONSORS OR ADMINISTERS THE PROGRAMS, SUCH AS THE UTILITY OR AGENCY NAME. IF THEY DON'T KNOW, STOP PROBING.]

1. [RECORD ANSWER]
2. (Don't know)
3. (Refused)

[ASK IF F1=2, 98, or 99]

F3. Why hasn't your company taken advantage of any rebates offered by utilities for improving energy efficiency at your properties?[RECORD VERBATIM. PROBE FOR MULTIPLE ANSWERS AND DETAILS]

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

F4. What could utilities and other agencies do to encourage your company to participate in rebate programs or to use financing options offered to assist property owners in making energy efficient upgrades to their properties? [DO NOT READ LIST. RECORD ALL THAT APPLY.]

1. (Provide more information about the programs)
2. (Simplify the information)
3. (Provide upgrades at no cost)
4. (Higher incentives/more money for rebate)
5. (Allow us to choose our own contractor to do the work)
6. (Provide on-bill financing)
7. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

G. ESAP Program Participation

THESE QUESTIONS WILL INFORM ABOUT AWARENESS AND USAGE OF THE ESAP PROGRAM.

G1. Have you ever heard of a program offered by the utilities which provides income qualified households with free equipment and services such as energy efficient lighting or appliances to help customers save energy and money on their energy bills? [IF NEEDED: This is also known as the Energy Savings Assistance Program (ESA).]

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[ASK IF G1=1]

G2. Do you know if any of your tenants at this location have taken advantage of this program?

1. (Yes)

2. (No)
98. (Don't know)
99. (Refused)

G3. This program requires you as property owners and managers to complete paperwork and allow contractors not hired by your company access to your property to make changes. Would you be supportive of tenants if they wanted to participate in the program?

1. (Yes)
2. (No)
3. (It depends [SPECIFY:_____])
98. (Don't know)
99. (Refused)

THESE QUESTIONS TELL US IF RESPONDENTS THINK THERE ARE BENEFITS TO UPGRADING WITH ENERGY EFFICIENT EQUIPMENT AND WHAT THE BENEFITS ARE.

[ASK IF C11=1]

G4. In what ways do you think energy efficiency upgrades that cut down on energy use in common areas such as hallways or laundry rooms benefit property owners? [RECORD ALL THAT APPLY; DON'T READ LIST]

1. (No benefit to property owners)
2. (Save money for owners/reduce costs for owners/reduce operating costs)
3. (Improve cash flow)
4. (More money for capital expenses)
5. (Increase property value)
6. (Nicer building/more comfortable)
7. (Good for environment, reduce greenhouse gases)
8. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

[ASK IF C11=1]

G5. And in what ways do you think your tenants benefit from having more energy efficient equipment that serves the common areas such as hallways or laundry rooms? [RECORD ALL THAT APPLY; DON'T READ LIST]

1. (No benefit to tenants)
2. (Save money for tenants)
3. (Lower rent)
4. (Not raise rent)
5. (Nicer building/more comfortable)
6. (Good for environment, reduce greenhouse gases, greener)
7. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

H. Building Characteristics

THESE QUESTIONS WILL PROVIDE INFORMATON ABOUT THE CHARACTERISTICS OF THE BUILDINGS AND UNITS.

Read: The next few questions are about the buildings and the units at the property we've been talking about.

H1. Earlier you said that there were [INSERT RESPONSE FROM A3] buildings at the [ADDRESS OR C_ADDRESS] property. How many floors are in a typical building at this location?

1. [RECORD NUMBER OF FLOORS:_____] [RANGE 1-9999]
98. (Don't know)
99. (Refused)

H2. How old are the buildings at [ADDRESS OR C_ADDRESS]?

1. [ENTER AGE IN YEARS:_____]
98. (Don't know) [ASK]
    H2a. Were they built before 1970?
    1. (Yes)
    2. (No)
    3. (Don't know)
99. (Refused)

H3. Are there two bedroom units at this property?

1. (Yes) [SKIP TO H5]
2. (No) [CONTINUE]
98. (Don't know) [CONTINUE]
98. (Refused) [CONTINUE]

H4. How many bedrooms are in the typical apartment? [READ LIST IF NEEDED]

1. (Mostly studios/SRO's (single room occupancy))
2. (Mostly one bedroom)
3. (Mostly 2 bedrooms)
4. (Mostly 3 bedrooms)
5. (Half studio/half 1 bedroom)
6. (Half one bedroom/half two bedroom)
7. (Mix of 1, 2 and 3 bedrooms)
8. (Other, [record answer _____]
98. (Don't know)
99. (Refused) [ASK EVERYONE]

H5. What is the average size of the [insert "2 bedroom" if H3 = Yes, OR, insert answer from H4] units at this location? [READ LIST IF NECESSARY]

1. (Less than 500 square feet)
2. (500 to less than 1,000 square feet)
3. (1,000 to less than 1,500 square feet)
4. (1,500 to less than 2,000 square feet)

5. (2,000 or more square feet)
98. (Don't know)
99. (Refused)

I. Typical Rent

THESE QUESTIONS TELL US ABOUT THE AVERAGE RENT AND WHO PAYS UTILITIES.

I1. What is the typical monthly rent for most [insert "2 bedroom" if H3= Yes, OR, insert answer from H4] bedroom units at [ADDRESS OR C_ADDRESS]? [ASK FOR BEST GUESS]

1. [RECORD ANSWER]
98. (Don't know)
99. (Refused)

I2. Are some or all of the utilities included in the rent? By utilities I mean, electricity, gas, water, sewer, and garbage.

1. (Some)
2. (All)
3. (None)
98. (Don't know)
99. (Refused)

[IF I2= 1 (SOME) OR 2 (ALL), ASK WHICH ONES]

I3. Which utilities are included? [READ LIST IF NECESSARY; RECORD ALL THAT APPLY]

1. (Electricity)
2. (Gas)
3. (Water)
4. (Sewer)
5. (Garbage)
98. (Don't know)
99. (Refused)

[ASK IF I2 = 3 (NONE)]

I4. Just to confirm, tenants are responsible for paying all utility bills, correct?

1. (No) [GO BACK TO I3 AND ASK WHICH ONES ARE INCLUDE IN THE RENT]
2. (Correct/yes, tenants pay the bill)
3. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

I5. Are there any other fees included in the rent?

1. (Yes)
   I5a. [ASK: What are the fees?_____]
2. (No)
98. (Don't know)
99. (Refused)

[ASK EVERYONE]

I6. Is the electricity at the property master metered, with one electricity meter for all the apartments in a building? Or, is each apartment individually metered for electricity?

1. Master metered
2. Individually metered
98. (Don't know)
99. (Refused)

I7. Roughly what percentage of your units at [ADDRESS OR C_ADDRESS] are occupied by low-income tenants? [IF NEEDED: Cost being a dominant consideration, possibly needing Section 8 housing or other low income housing assistance such as HUD funded programs.][INTERVIEWER NOTE: Low income can be considered 80% of area median income (AMI).]

1. [ENTER PERCENTAGE:_____]
98. (Don't know)
99. (Refused)

I8. Roughly what percentage of the properties you own or manage in California are subsidized by local, state, or federal housing assistance programs such as Section 8 vouchers?

1. [ENTER PERCENTAGE:_____]
98. (Don't know)
99. (Refused)

I9. And about what percentage of <u>all of the units you own or manage in California</u> would you say are occupied by low-income tenants? [IF NEEDED: "Cost is a dominant consideration for their housing and the tenants rely on assistance programs for their daily living and/or income."]

1. [RECORD PERCENTAGE:_____] [RANGE 0-100%]
98. (Don't know) [CONTINUE]
99. (Refused) [CONTINUE]

THESE QUESTIONS OUTLINE WHETHER THERE ARE RENT RESTRICTIONS, WHAT THEY ARE, AND WHETHER THEY RECEIVE TAX BENEFITS.

I10. Are there any restrictions around what can be charged for rent or are you charging market rate at [ADDRESS OR C_ADDRESS]? [DO NOT READ LIST AND RECORD ALL THAT APPLY]

1. (Restrictions) [ASK I11]
2. (Market rate) [SKIP TO I12]
3. (Other [SPECIFY:_____]) [ASK I11]
98. (Don't know) [SKIP TO I12]
99. (Refused) [SKIP TO I12]

[ASK IF I10= 1 OR 3]

I11. Please tell me about the restrictions.

[RECORD ANSWER and mark if they say "rent control" ENTER ALL THAT APPLY]

1. [ENTER ANSWER_____]
2. (Rent Control)
98. (Don't know) [CONTINUE]
99. (Refused) [CONTINUE]

[ASK IF I11 NOT MARKED "RENT CONTROL"] I12.Is this a rent controlled property?

1. (Yes)
2. (No
98. (Don't know) [CONTINUE]
99. (Refused) [CONTINUE]

[ASK EVERYONE]

I13. Does your company, get annual income tax benefits for providing subsidized rents?

1. (Yes)
2. (No)
3. (Non-profit/parent company gets tax benefits but we don't)
4. (Other [SPECIFY:_____])
98. (Don't know) [CONTINUE]
99. (Refused) [CONTINUE]

J. Closing

THIS QUESTION IS TO GET EMAIL ADDRESS FOR PEOPLE INTERESTERD IN SEEING THE FINAL REPORT.

J1. These are all my questions. Would you like to see the final report once it is public?

1. (Yes [ASK: Can I get your email address?_____])
2. (No)
98. (Don't know)
99. (Refused)

READ: Thank you for your taking the time to give us your views. Your opinions are extremely important to the California utilities and to this research about low income multifamily housing.

(End of Volume 2)